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MARCH 31, 1952

American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

This 3-dimensional control cam cost $2800 — see page 2

Eight Ways to Grind Ways

How to Work Beryllium–Copper Strip– A SPECIAL REPORT

air superiority starts here

...where Heald's specialized engineering talent paves the way for faster, better production of aircraft parts

Any job is easier if you *know* how to do it. And when it comes to solving complex production problems — in any field — Heald engineers *do* know the answers. That's because Heald's staff of more than 200 trained engineers includes skilled specialists in every type of precision finishing.

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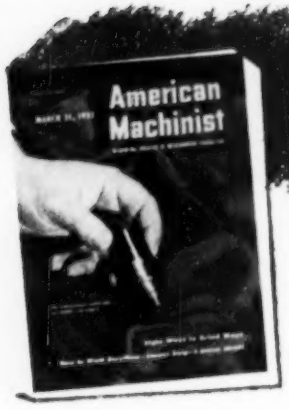


Chips and Curls

Precision Costs Money . . . The 3-dimensional master control cam, shown full size on our cover, is a $2800 item because of its exactness. The 1 sq in. of cam surface contains 720 points, or stations, exact to under half a tenth. Parker Stamp Works, in Hartford, has made three, for various companies engaged in the defense program, so has worked out a technique that's unusual and interesting. Chief Engineer Mallory (see biog) finally agreed to tell us *almost* all about it in our lead article. All the details aren't included—after all, Parker has a trick or two that resulted in success on a job nobody else wanted—but there's plenty to show you how to go about making a similar exact profile.

Change . . . Things change so rapidly these days that we have to turn each issue inside out two or three times. There's our lead article about the cam—approved at the last minute—and an article on trepanning, again a last-minute release. 'Twould be easier to wait a couple of weeks and drop them in our next issue, but it wouldn't be smart. As Gen Nathan Bedford Forrest said about winning battles, you've got to "get there fustest with the mostest."

For Bulletins . . . G C Wadsworth, senior engineer of the Technical Enquiry Section, Production Engrg Research Assn of Great Britain, Staveley Lodge, Melton Mowbray, Leicestershire, England, asks about manufacturers' literature. There are about 300 member firms, so the association maintains a library of trade literature, would like to include American bulletins and catalogs. Send 'em along to Mr. Wadsworth.

Trepanning . . . Fred Lucht, development engineer at Carboloy, describes the trepanning process, including cutters, feeds and speeds, and conversion of conventional machine tools for the job. It's a low-cost way to bore a hole . . . Also of interest to tool engineers is a description of how die elements make up dies at McCulloch Motors in Los Angeles . . . And Frank Charity describes a method for developing a standardized assembly tool by rigidizing the "tooling dock" of World War II, which was used primarily to facilitate assembly of prototype airplanes. The new idea is a production tool, not a tooling device.

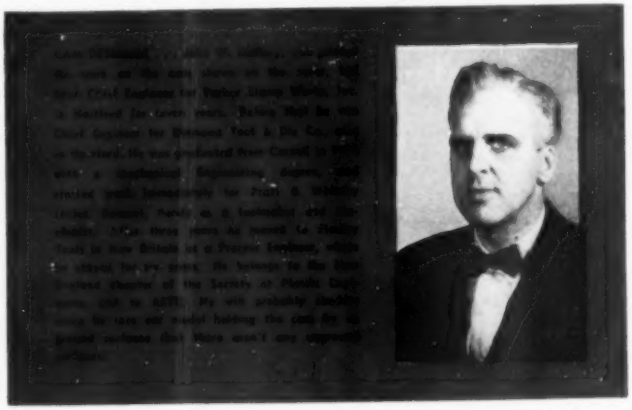
Weldments . . . American Machine & Foundry Co, Brooklyn (N Y) plant, makes some elaborate welded assemblies. We show examples, in pictures, of the variety of techniques required.

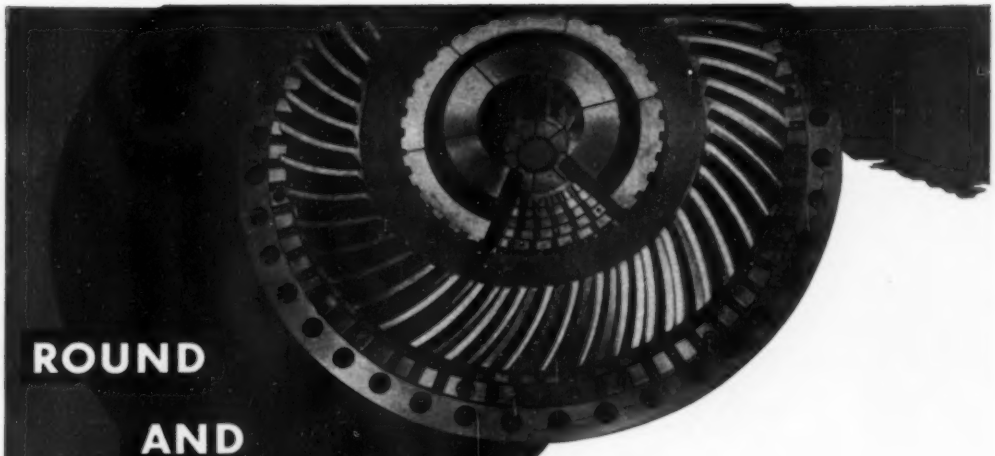
MT Ways . . . Operation sequences and wheel arrangements for eight ways of grinding machine-tool ways are explained by R R Baldenhofer, works manager of Thompson Grinder Co. It's a picture-caption story showing close-ups of machine work areas and covering a variety of grinding problems on bedways, large and small.

Beryllium Copper . . . John T Richards of Beryllium Corp returns to us in this issue with the know-how on beryllium-copper strip. He describes how to blank, form, heat-treat, join, clean and plate it. He also gives precautions to observe in selecting the best temper. Another of our "how to" Special Reports, with reprints available, as usual.

Torsioneer . . . A ship may be substantial enough—particularly a fighting ship—but it provides fairly unstable foundations for machine tools. Reed-Prentice engineers designed a lathe to stand up to the service, with a welded bed and ball-and-socket supports. Here's how it's done—in a compact article. You will recall that we described another such design last June 11 (p 154).

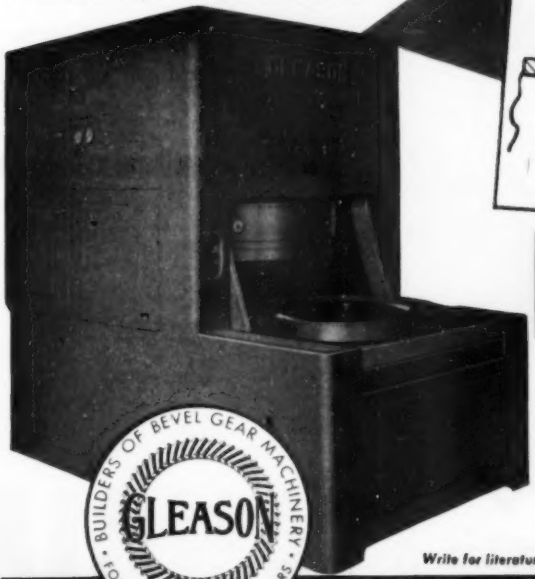
Coming . . . AM for April 14 will include a Special Report on how Sperry makes wire harnesses, plus articles on estimating hobbing time, on chip handling at Ford, on industrial X-ray, on broaching, Talented Tooling in pictures, heat-treating clutch parts, and several other subjects. There'll also be our usual departments and features. Reprints of the Special Report will, as usual, also be available.

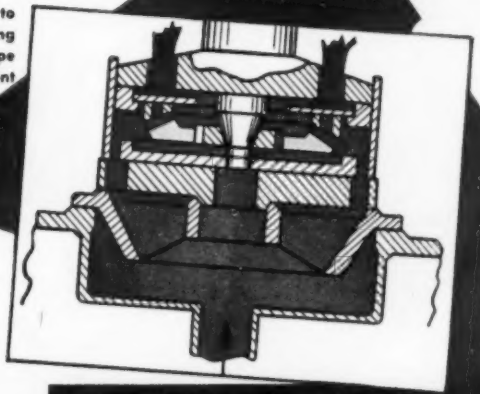




ROUND AND TRUE *with* DISTORTION-FREE QU[illegible]NG

When hardening of metal parts is required, the first thought is to prevent distortion. Gleason quenching presses hold parts being quenched between dies which maintain the original shape throughout a metallurgically correct oil flow. This die equipment conforms to the actual shape of the part, and does not obstr[illegible] free oil flow over and around the part. It maintains true c[illegible] tric shape of the part during the entire quench.





Timing cycle begins and quenching oil is forced into quenching chamber and around gear. Quantity and time cycle are under positive control during complete quenching cycle.

In the Gleason No. 36 Quenching Press parts up to 36" may be hardened. Among the many advantages which the 36" Press provides are:

- Controlled quenching at faster and safer production
- Simplified set-ups
- Metallurgically correct oil flow
- Safer loading
- Quenching without distortion

Write for literature. Send in prints of parts to be quenched for our recommendations.

BUILDERS OF BEVEL GEAR MACHINERY FOR OVER EIGHTY-FIVE YEARS — GLEASON

GLEASON WORKS

1000 UNIVERSITY AVENUE · ROCHESTER 3, NEW YORK

COMPLETELY AUTOMATIC SETUP

CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machine with automatic fixtures for milling the serrations in both ends of brake pedal shafts, at a production rate of 123 per hour.

CINCINNATI

CIN

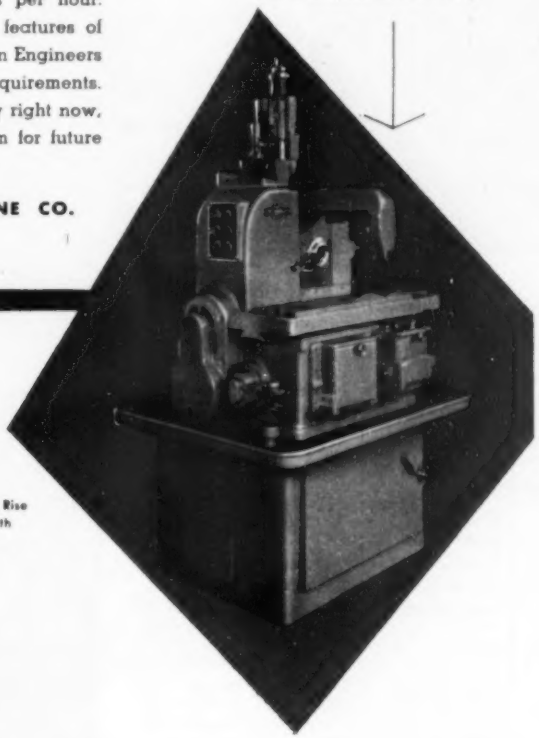
MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES

FOR AUTOMOTIVE PART
with Defense Application Possibilities

Costs descend vertically and operators are happy with the automatic equipment illustrated here. It's a CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machine, with a magazine type fixture. All the operator has to do is stack work on a shelf; the machine and fixture take over the job of loading, clamping, milling and ejecting. ¶ In one operation, serrations on both ends of brake pedal shafts are automatically milled with this setup. The machine's hydraulic rise and fall feature is the deciding factor in taking these two milling cuts. After taking the first cut the spindle carrier automatically rises, the table repositions, and then the carrier advances down to accurate depth for the second cut. Production averages 123 shafts per hour. ¶ CINCINNATI No. 0-8 Automatics have many features of value for this type of work, and our Application Engineers have the know-how to tool them up to your requirements. Of course, these machines are in short supply right now, but you might like to know more about them for future applications. Ask for catalog No. M-1607-1.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machine. Catalog No. M-1607-1 contains complete specifications.



Drawing of part and diagram of automatic cycle.

Part name	Brake pedal shaft
Material	Steel
Operation	Mill serrations, both ends
Cutting speed	110 ft. per minute
Table feed	12" per minute
Production	123 per hour
Equipment	CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machines, with automatic fixtures

CINNATI

FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

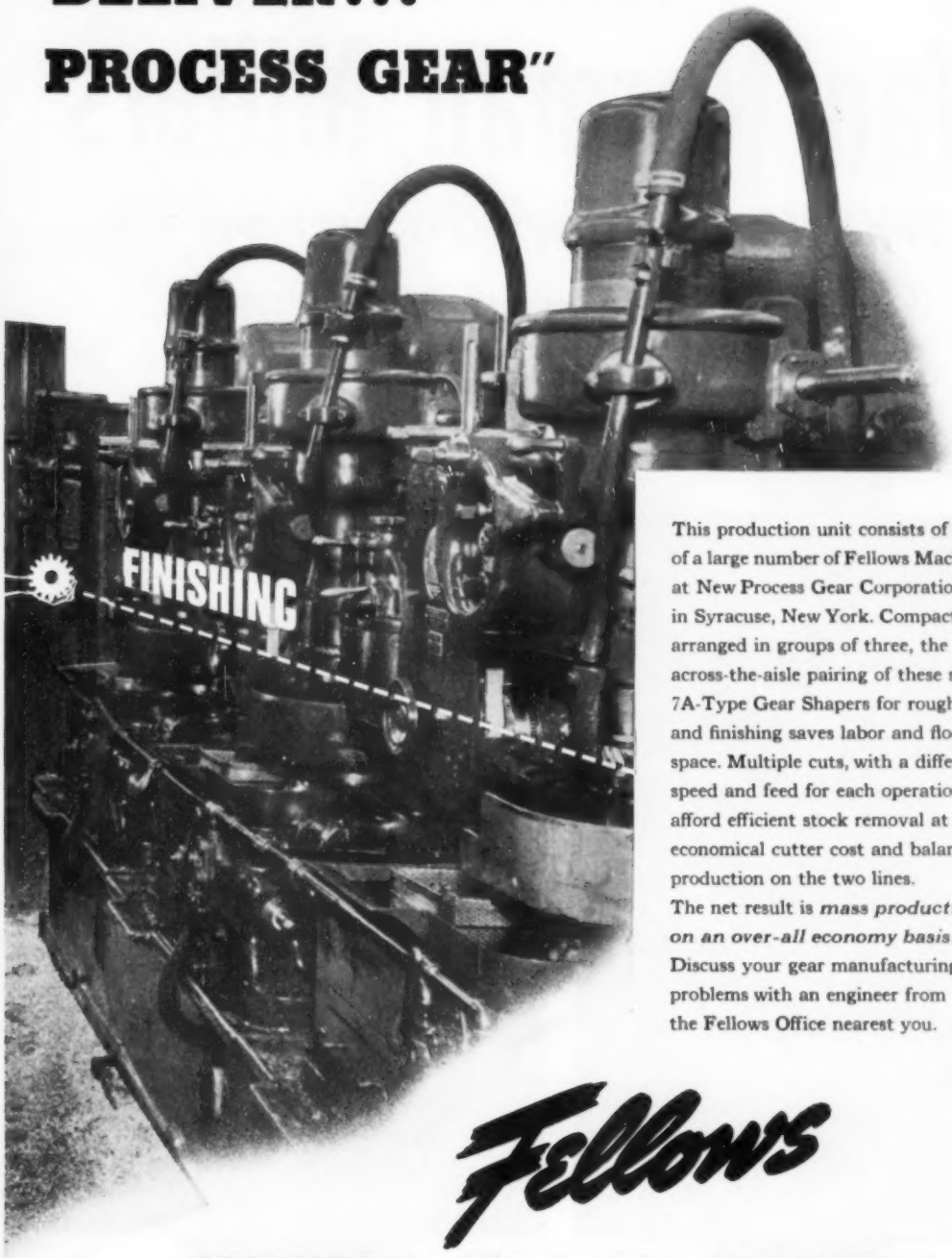
FELLOWS MACHINES AT "NEW

GEAR SHAPER PERFORMANCE

	ROUGHING	FINISHING
General Description	External Cluster Gear	Same
Material	SAE 4027	Same
Number of Teeth	27	Same
Pitch	7/9	Same
Helix Angle	23° 13" R.H.	Same
Pressure Angle	20°	Same
Face Width	1.000 inch	Same
Number of Cuts	3-cut cam	2-cut cam
Cutter Spindle Speed	450 strokes per min.	300 strokes per min.
Feed	.016" per stroke	.024" per stroke
Production Rate per machine	7 Pieces per hour	7 Pieces per hour

Production rate is floor to floor, and is based on 85% efficiency.

DELIVER...
PROCESS GEAR"



This production unit consists of 6 of a large number of Fellows Machines at New Process Gear Corporation in Syracuse, New York. Compactly arranged in groups of three, the across-the-aisle pairing of these six 7A-Type Gear Shapers for roughing and finishing saves labor and floor space. Multiple cuts, with a different speed and feed for each operation, afford efficient stock removal at an economical cutter cost and balanced production on the two lines.

The net result is *mass production on an over-all economy basis*. Discuss your gear manufacturing problems with an engineer from the Fellows Office nearest you.

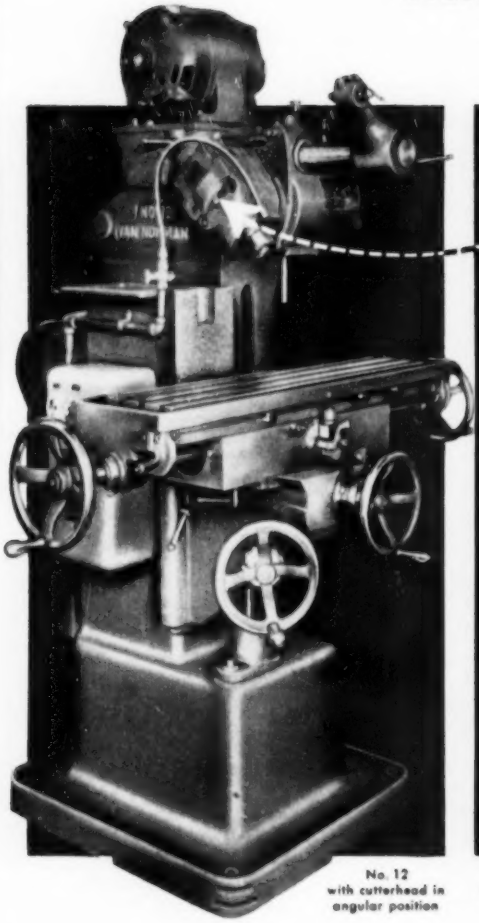
Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont
Branch Offices: 323 Fisher Bldg., Detroit 2 • 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1

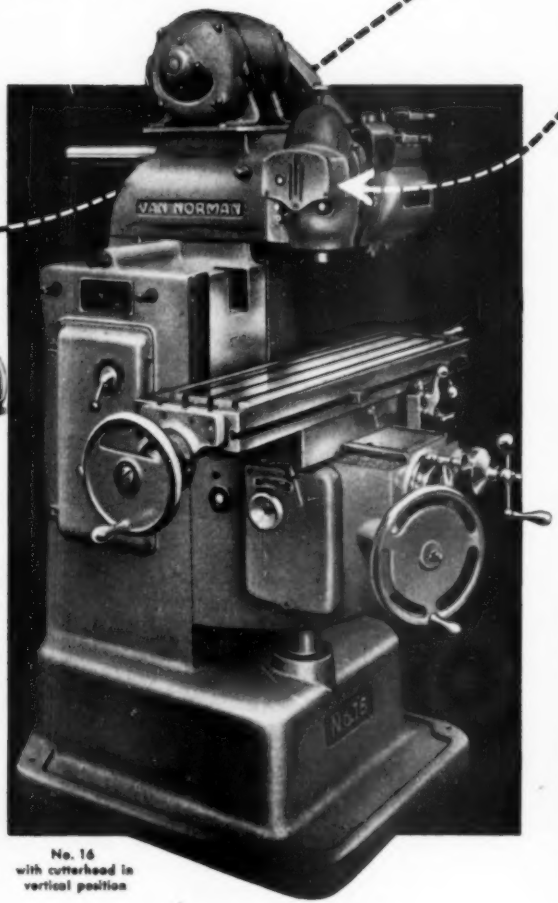
These Two

Van Norman Millers

Will Keep Your Production Up on Light and Medium Milling



No. 12
with cutterhead in angular position



No. 16
with cutterhead in vertical position

The Adjustable Cutterhead Eliminates Idle Machine Time... Meets All Milling Requirements

Here are two Van Norman Ram Type Millers, No. 12 and No. 16 that provide definite contributions to faster, more economical milling of small and medium size parts.

Featuring the adjustable cutterhead, which permits conventional horizontal, angular and vertical milling on one machine, these millers cut idle machine time by as much as 50%.

The movable ram in combination with the saddle cross feed increases the work capacity of the millers . . . enables you to handle all types of work pieces with ease.

Van Norman features include — rugged column and base, hardened alloy steel gears, multi-splined shafts, easy-to-read dials, large hand wheels, heavy knee, saddle and table assembly, anti-friction bearings, ease of operation.

See for yourself how these machines cut costs, improve accuracy and increase production in the toolroom, machine shop, laboratory and pattern shop and on the production line. Write for catalog today.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

PIPE NIPP

450 pieces
3600 pieces

WORLD'S LARGEST MANUFACTURER OF ALL TYPES

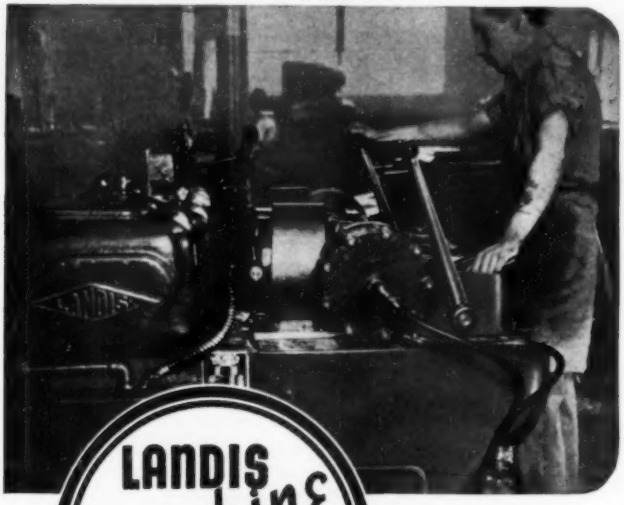
LES

per hour per chaser grind

Such production is proof of "high production and low cost"—yet thread tolerances are held to specifications. These figures are production results of a manufacturer producing steel pipe nipples, using LANDMACO machines equipped with air-operated carriage fronts. Different conditions might make an even higher output possible.

LANDMACO Pipe and Nipple Threading Machines thread, ream, and chamfer in one operation. Built in 1¼" and 2" single- and double-head models, these machines are equipped with either internal or external trip heads.

Write for Bulletin D-84



LANDIS MACHINE COMPANY
ENGINEERING DATA
Name of Part 3/4" x 2 1/2" Pipe Nipple
Material Galv Butt Weld Pipe
Thread Pitch 14
Thread Limits ± 1 1/2 Turns
Thread Length 13/16"
Cutting Speed 33 Ft. P.M.
Pieces per Hour 450
Chaser Grind 22° and 88°
Pieces per Chaser Grind 3600

ENGINEERING DATA
Name of Part 3/4" x 10" Pipe Nipple
Material Butt Weld Pipe
Thread Pitch 14
Thread Limits ± 1 1/2 Turns
Thread Length 13/16"
Cutting Speed 38.3 Ft. P.M.
Pieces per Hour 400
Chaser Grind 22° and 88°
Pieces per Chaser Grind 3400

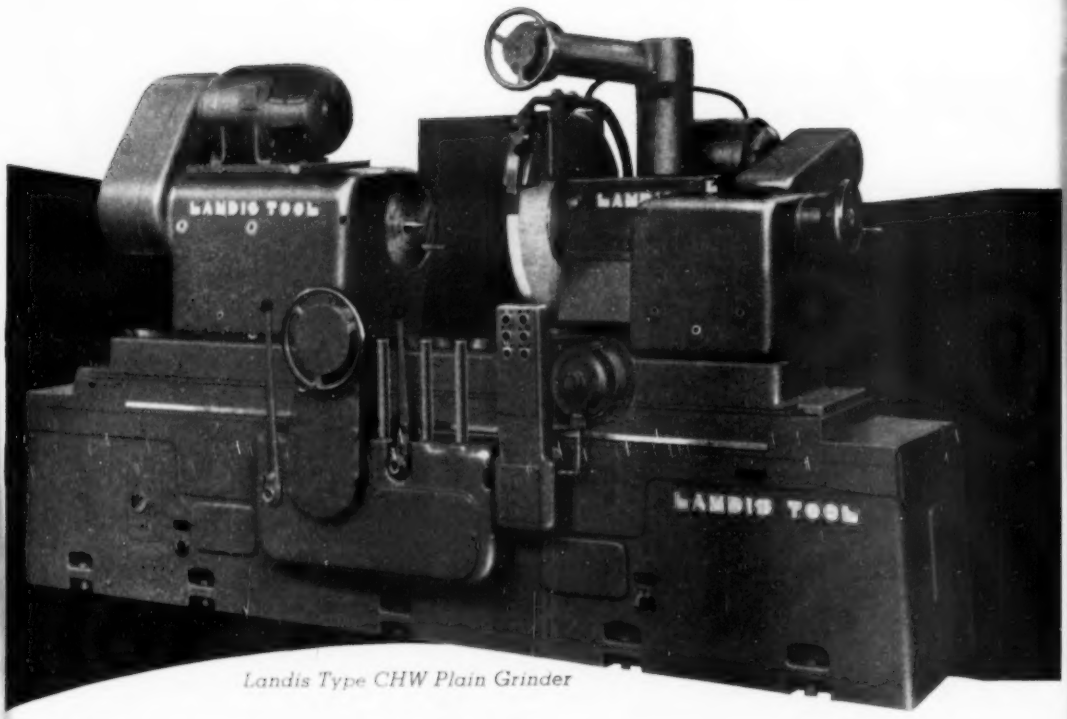
ENGINEERING DATA
Name of Part 2" x 6" Pipe Nipple
Material Butt Weld Pipe
Thread Pitch 11 1/2
Thread Limits ± 1 1/2 Turns
Thread Length 1 1/16"
Cutting Speed 42.8 Ft. P.M.
Pieces per Hour 200
Chaser Grind 22° and 89 3/4°
Pieces per Chaser Grind 1800

ENGINEERING DATA
Name of Part 1 1/2" x 5" Pipe Nipple
Material Butt Weld Pipe
Thread Pitch 11 1/2
Thread Limits ± 1 1/2 Turns
Thread Length 1"
Cutting Speed 35.8 Ft. P.M.
Pieces per Hour 232
Chaser Grind 22° and 89 3/4°
Pieces per Chaser Grind 2000

LANDIS Machine COMPANY
WAYNESBORO PA., U.S.A.

OF THREADING EQUIPMENT

New Landis Plain Grinder..



Landis Type CHW Plain Grinder

Designed for large volume production

This new LANDIS Plain Grinder has been designed to meet the demand for large scale production, as well as maintenance grinding of large diameters.

Wide carriage ways are provided to give the extra stability required for the work carrying parts of high swing precision grinders. All controls are raised and grouped for convenient operation.

For any help you need on such grinding problems, consult Landis Engineered Grinding Service. We will be glad to give production estimates and tooling recommendations on the basis of your blueprints.

LANDIS
precision grinders

sizes available (Swing and Length between centers)

24" x 48"	30" x 48"	36" x 48"	48" x 48"
24" x 72"	30" x 72"	36" x 72"	48" x 72"
24" x 96"	30" x 96"	36" x 96"	48" x 96"
24" x 120"	30" x 120"	36" x 120"	48" x 120"

..for Large Diameter Work

Grinding the outside diameter of the blades on a 30" jet turbine rotor.

NEED NEW MACHINES: Drastic changes in aircraft engines are creating machining problems that cannot be handled satisfactorily on orthodox machine tools. The new axial-flow gas-turbine engines call for production techniques unlike those encountered in building reciprocal engines or centrifugal-type turbojets. Among the new problems is that of machining a wide range of components of large diameter and thin wall section.

From a recent editorial in Steel magazine.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

No pre-layout needed

TO BORE 61 HOLES IN 110" DIA. GAGE RING CENTERS HELD TO ± .0004"

There's one essential thing you must have to save time and money in most metalworking shops — and that's imagination! And Giddings & Lewis Horizontal Boring, Drilling and Milling Machines give your imagination the widest range of machining possibilities with which to work.

Why? Because they're multi-purpose machines with open-type construction. That means you can perform one or several operations on a work-piece in a single setup — accommodate work-pieces large and small . . . simple or complex. What's more, there's a size or type in a working range best suited to your particular shop needs. To find out more, see your nearest Giddings & Lewis representative at once or write direct. Ask about the Giddings & Lewis Job Analysis service . . . and don't forget . . . DELIVERY MAY BE BETTER THAN YOU THINK!

Giddings & Lewis' 5 point "Job Analysis Service" takes the guesswork out of buying heavy machine tools . . . works for you and with you to solve big and complex machining problems . . . increases production . . . reduces machining costs.

1. COMPLETE STUDY OF YOUR JOB OR JOBS—G&L Job Analysis Engineers, working with your engineers completely analyze your machining requirements.

2. DETERMINE MOST EFFICIENT MACHINING METHOD — G&L engineers can give an unbiased opinion because G&L builds a complete line of sizes and types of planers, planer-millers, vertical boring and turning mills and horizontal boring, drilling and milling machines . . . plus a complete line of accessories and tooling for these machines.

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Call your nearest G&L dealer or write us direct. Furnish our Job Analysis Engineers with blueprints, job data and production requirements. Factory engineers will completely analyze your machining problems. There's no charge, no obligation. Don't hesitate — do it today.

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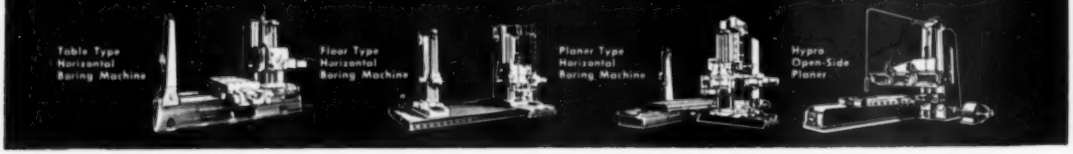
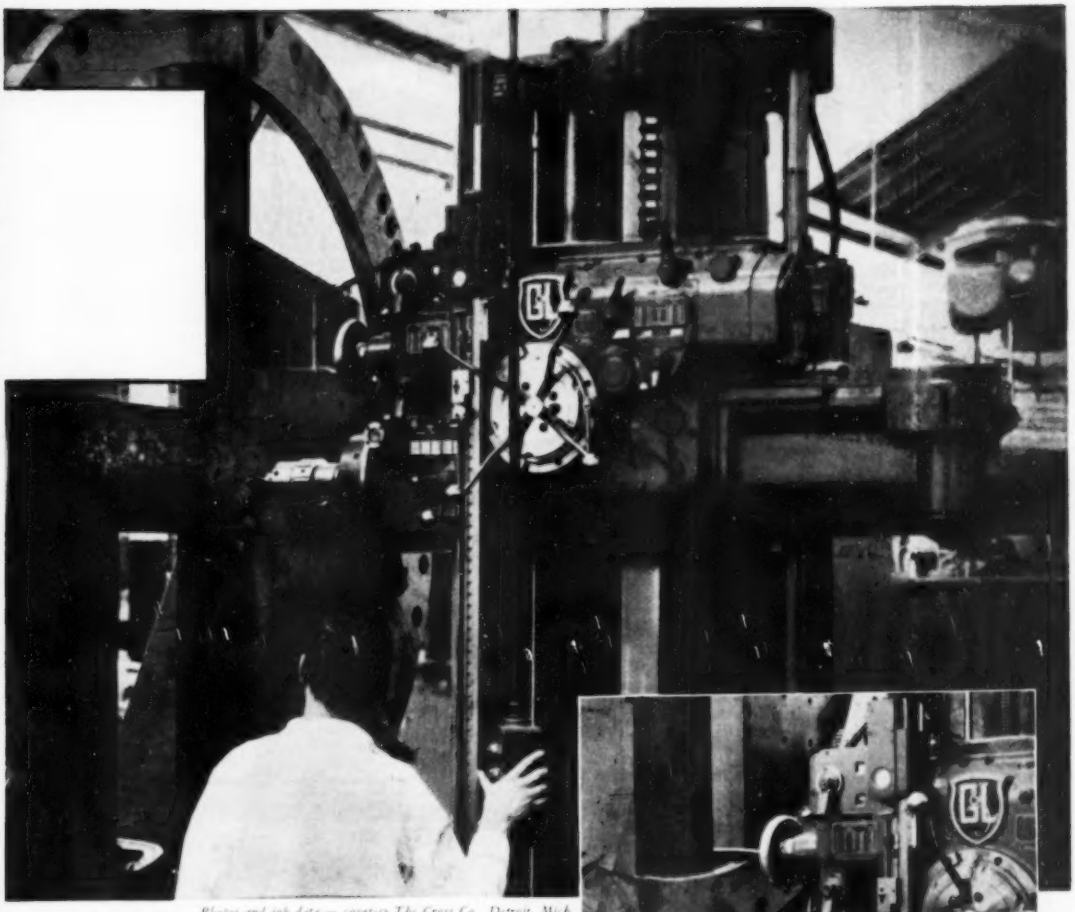


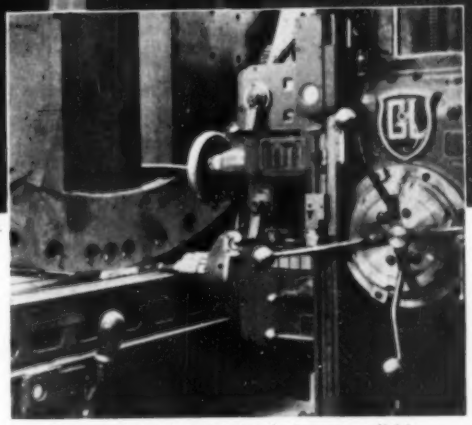
Table Type Horizontal Boring Machine
Floor Type Horizontal Boring Machine
Planer Type Horizontal Boring Machine
Hypro Open-Side Planer



Photos and job data — courtesy The Cross Co., Detroit, Mich.

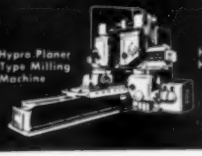
It's on the tough, unusual jobs like this one that Giddings & Lewis Horizontal Boring, Drilling and Milling Machines pay their way many times over.

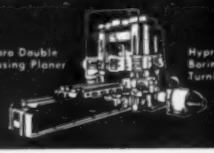
Exclusive automatic positioning is so reliable that no time is lost laying out the job. Open-type construction gives operator plenty of room to make the setup. The operator establishes his original center, then the electric positioning device aligns the headstock and table into proper position for each subsequent bore.



Close-up of electric positioning device — note dial indicators on table and head stock. Precision rods also used.

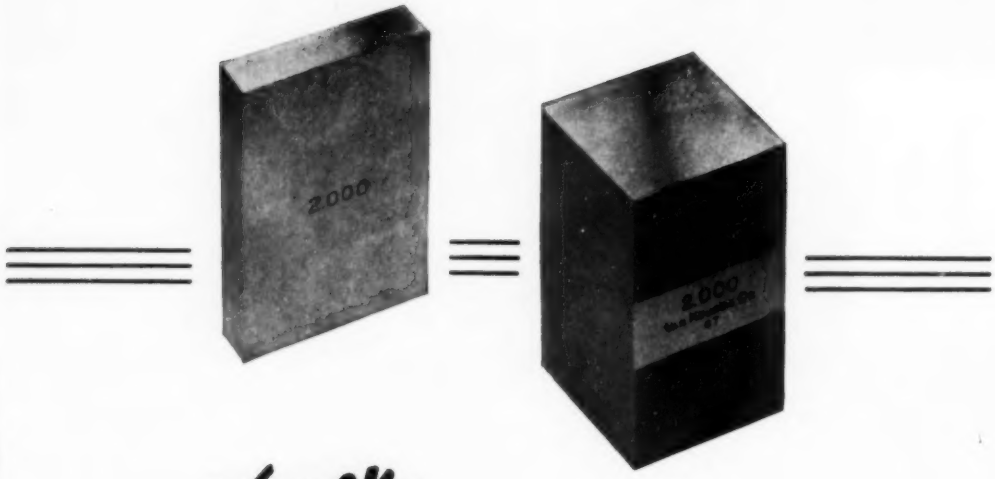
MACHINE TOOL CO.





G&L HYPRO

FOND DU LAC
WISCONSIN



Van Keuren GAGE BLOCKS

Conventional Rectangular Gage Block.	SOLID SQUARE MASTER BLOCK.
.360 by 1.375".	1¼" by 1¼".
Area .51 square inches.	Area 1.56 square inches.
For ordinary use.	The 30 Year Blocks.

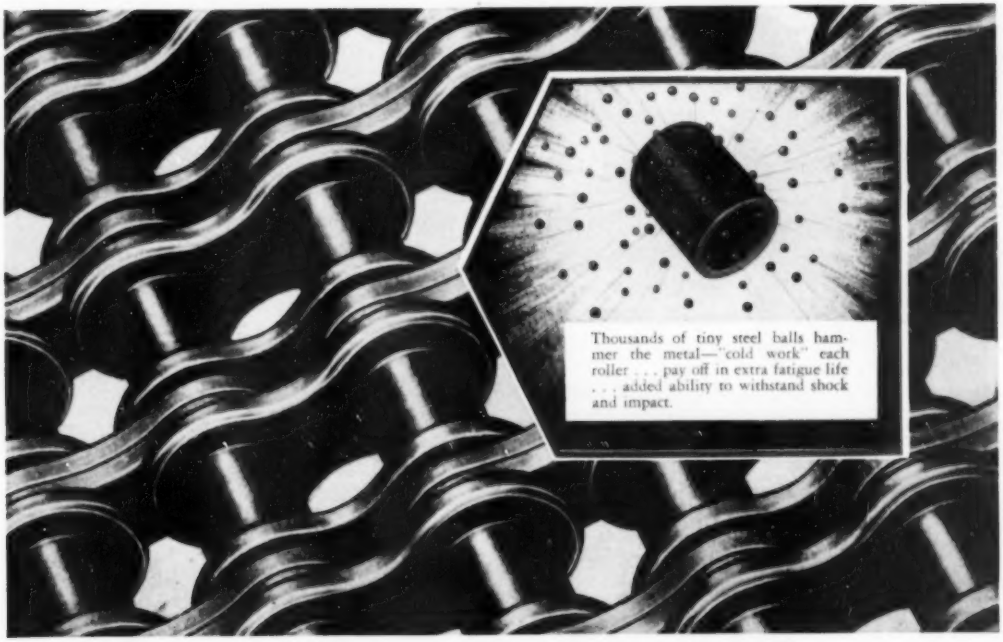
Read about the startling wear tests on Van Keuren Solid Square Master Blocks.

They are unconditionally guaranteed against wear in excess of .0001" for 5 years for any reason whatsoever.

Write for your Van Keuren 1952 Catalog and Handbook No. 35

THE Van Keuren CO.,
173 WALTHAM STREET, WATERTOWN, MASS.
33rd YEAR
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carbaloy Cemented Carbide Plug Gages • Carbaloy Cemented Carbide Measuring Wires

Get the roller chain that gives you SHOT-PEENED rollers...


Thousands of tiny steel balls hammer the metal—"cold work" each roller . . . pay off in extra fatigue life . . . added ability to withstand shock and impact.

look for the darkened rollers!

THERE are sound reasons for the universal acceptance of Link-Belt Precision Steel Roller Chain. Two of them—shot-peened rollers and Lock-type Bushings—are shown here.

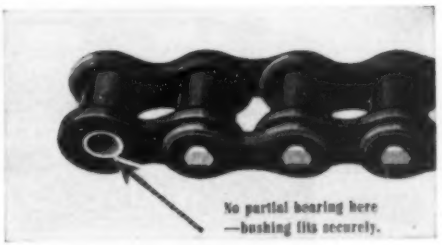
Others include Link-Belt's rigid material selection and controlled heat treating—your assurance of absolute uniformity with no weak members.

Whether it's for drive or conveyor service, you can get the best in roller chain from the complete Link-Belt line—single and multiple widths, in ⅜" through 3", and double pitch, 1" through 3". Next time you need roller chain, call the Link-Belt office near you.

LINK-BELT

PRECISION STEEL ROLLER CHAIN

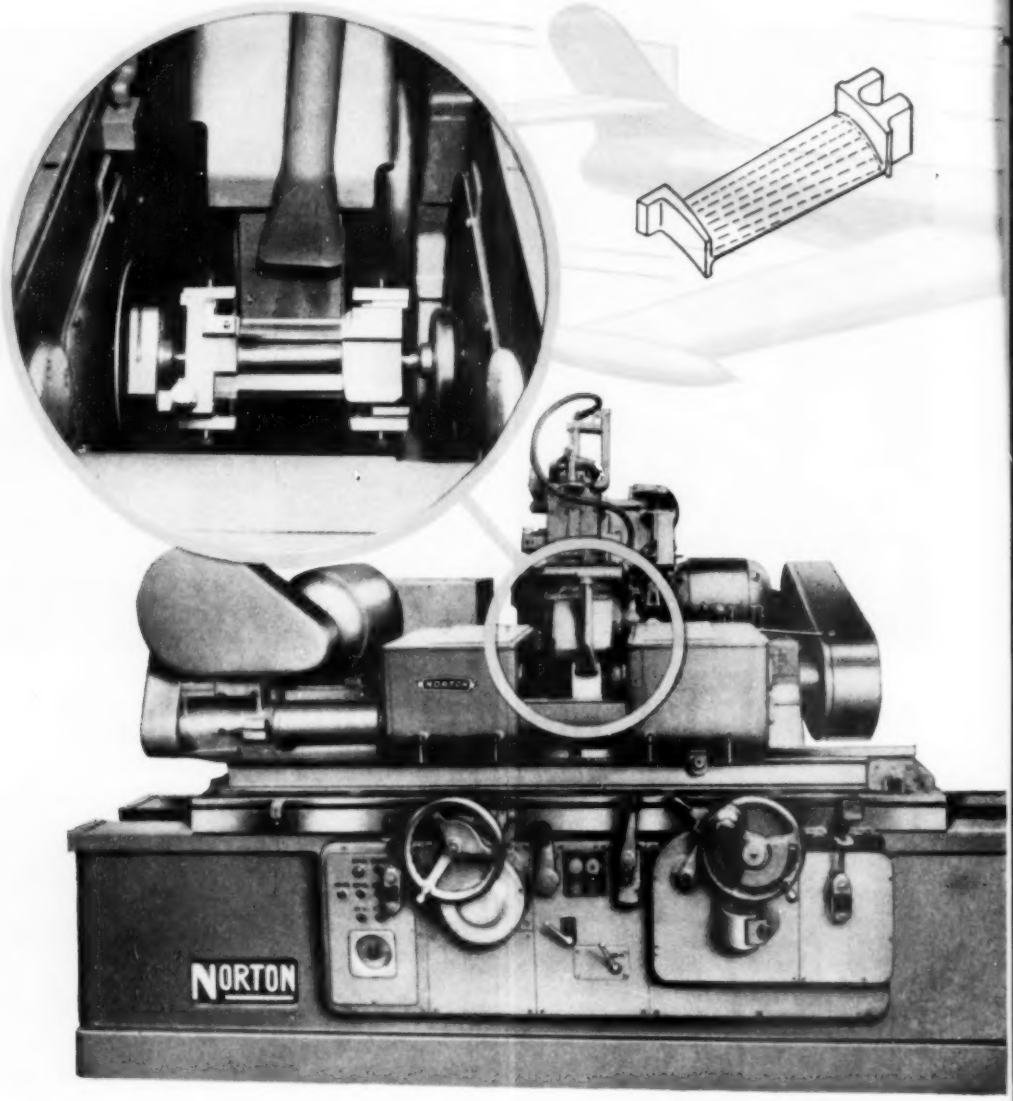
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in Principal Cities. 52.R97



Lock-type Bushings increase ability to withstand shock loads

A special manufacturing process securely locks the inside sidebars on the bushing, preventing lateral movement of the sidebars and eliminating a common cause of stiff chains. This Link-Belt development is applied on roller chains through 1" pitch and double pitch roller chains through 2" pitch.

One-plunge Grind for the External Airfoil Surface of Turbojet Buckets or Blades ..... on the



Making better products to make other products better

NORTON COMPANY, WORCESTER 6, MASS., U. S. A.

DISTRICT SALES OFFICES: HARTFORD • NEW YORK • CLEVELAND • CHICAGO • DETROIT

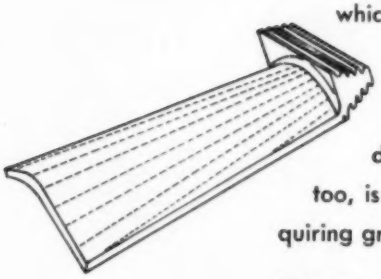
NORTON Compound Contour Jet Blade Grinder

[Patent Applied for]

The complicated engineering problem of grinding jet engine buckets and blades having twisted contour but with straight line fairing has been solved.

The NORTON Compound Contour Jet Blade Grinder plunge grinds blades semiautomatically with a positive control of contour and finish of the external airfoil surface.

An ingenious arrangement of cams in dual shape-producing units provides the precisely correct motion for the workpiece which presents the surfaces to be ground at the horizontal centerline of a wide grinding wheel.



This set-up permits efficient grinding, high production and consistently high quality. Important, too, is the fact that all this is accomplished without requiring great effort or skill on the part of the operator.

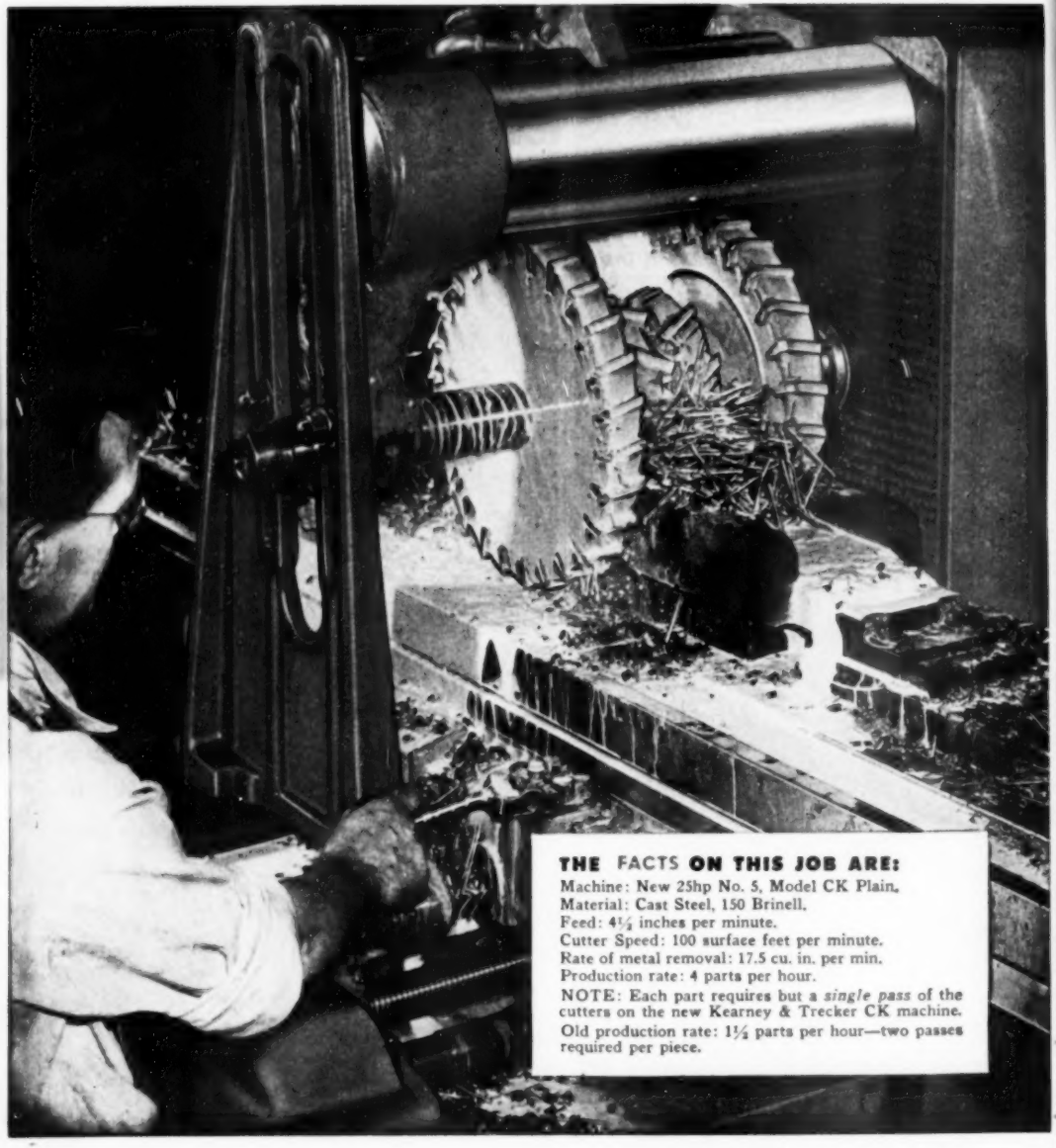
This unique, new NORTON design includes many important engineering features and principles proved in the NORTON Type CTU line of cylindrical grinding machines.

If you, too, have the problem of obtaining high production and consistent accuracy combined with ease of operation in grinding complicated shapes, our engineers will be glad to provide specific recommendations—at no obligation to you.

To Economize Modernize with NEW NORTON GRINDERS and LAPPERS

facts tell the story

{ NEW CK USER BIG



THE FACTS ON THIS JOB ARE:

Machine: New 25hp No. 5, Model CK Plain.
Material: Cast Steel, 150 Brinell.
Feed: 4½ inches per minute.
Cutter Speed: 100 surface feet per minute.
Rate of metal removal: 17.5 cu. in. per min.
Production rate: 4 parts per hour.

NOTE: Each part requires but a *single pass* of the cutters on the new Kearney & Trecker CK machine.

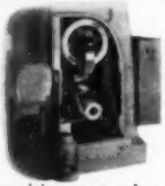
Old production rate: 1½ parts per hour—two passes required per piece.

MILLING MACHINE PAYS PRODUCTION DIVIDEND

NEW 25HP CK PLAIN MACHINE OUT PRODUCES PREVIOUS MACHINE NEARLY 4 TO 1!

CK MILLING MACHINE FEATURES THAT HELPED DO THIS JOB BETTER

Greater rigidity of new CK column easily absorbed vibration from heavy cutting load. Only single pass needed for each part.



CK's positive, metered pressure and automatic lubrication assured cool, wear-free operation in spite of heavy cutting load.

No. 60 heavy-duty drive flange around spindle nose permitted use of an extra-rigid heavy-duty arbor on this multiple cutter setup.

CK's 3-bearing spindle and flywheel assure Maximum Cutter Efficiency. On this job it meant fast metal removal and smooth finish in a single pass.

The new Kearney & Trecker CK milling machine doing this job has 24 different spindle speeds (13 to 1300 rpm.) Its 32 different table feeds range from ¾" to 90" per minute. Thus operator was able to *pick exact speed and feed* to get fullest advantage from high horsepower and modern cutting tools. This meant Greater Productivity on this job.

Smoother Feed of CK's large (2" dia.) screw and extra-long table feed nut with backlash eliminator permitted heavy cut.

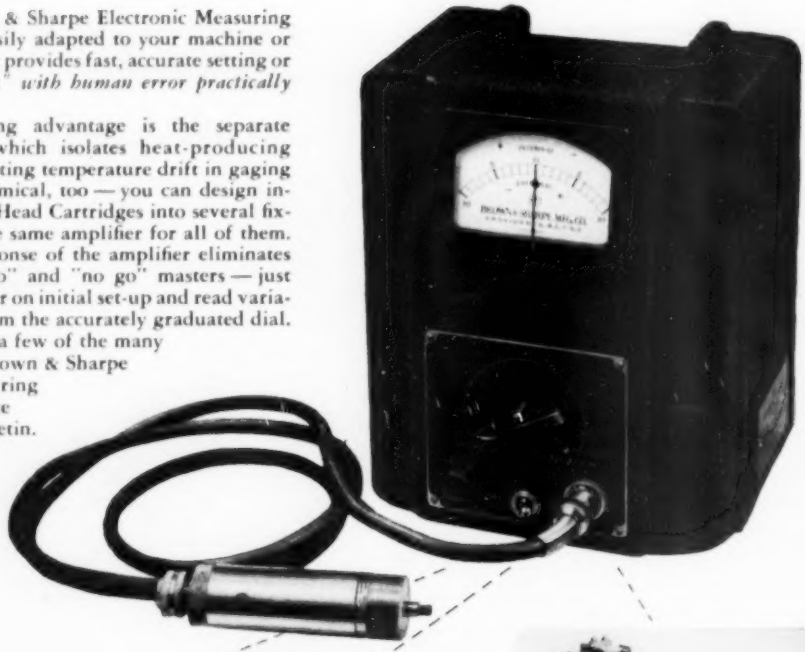
New CK machines have Greater Horsepower. On this job, 25hp enabled operator to get maximum production from his cutters.

New No. 4 Model CK 25hp Plain

Investigate the new CK line of milling machines. You'll find every feature is test and job-proven to give you cost-cutting results . . . greater machine capacity, productivity and better finished products. Contact your nearest Kearney & Trecker representative or write: Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

Build "*tenths of tenths*" measuring into your equipment

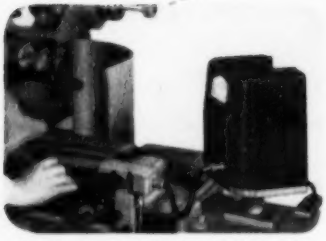
Brown & Sharpe Electronic Amplifier No. 950 for .0001" to .00001" readings. Gage Head Cartridge No. 953 is plugged in.



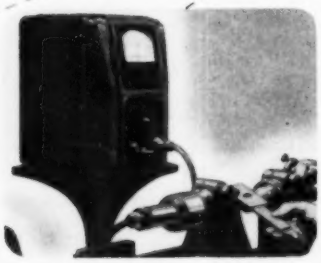
Versatile Brown & Sharpe Electronic Measuring Equipment is easily adapted to your machine or fixture design. It provides fast, accurate setting or gaging to .00001" *with human error practically eliminated.*

An outstanding advantage is the separate amplifier unit which isolates heat-producing elements, preventing temperature drift in gaging units. It's economical, too — you can design inexpensive Gage Head Cartridges into several fixtures and use the same amplifier for all of them. True linear response of the amplifier eliminates the need for "go" and "no go" masters — just "zero" the pointer on initial set-up and read variations directly from the accurately graduated dial.

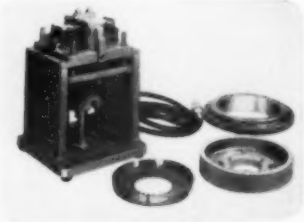
These are but a few of the many advantages of Brown & Sharpe Electronic Measuring Equipment. Write for detailed Bulletin. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



Electraligo — an application of this precision electronic equipment in Brown & Sharpe's own grinding machines. Permits fast, accurate setting of swivel table for precision grinding straight work or exact tapers after a single trial grind.



Gage Head Cartridge No. 953 mounted on fixture to measure a fixed gage . . . used with Amplifier No. 950. Standard comparators for external or internal measuring also available.



Special fixture utilizes Gage Head Cartridge and Amplifier to measure internal angle accuracy to ± 1½ seconds independently of bore size and without reference to locating surface.

WE URGE BUYING THROUGH THE DISTRIBUTOR

Brown & Sharpe B·S

NEW PRODUCT DESIGNS DEMAND NEW MACHINING METHODS

This New Britain Automatic developed for contour facing jet compressor wheels

AUTOMATIC BAR AND CHUCKING MACHINES • PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING AND MILLING MACHINES

NEW BRITAIN
Automatics
THE NEW BRITAIN GRIDLEY MACHINE DIVISION
THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT

PRATT & WHITNEY • DIVISION NILES-BEMENT-POND COMPANY

PRATT & WHITNEY

FIRST CHOICE FOR *Accuracy*

Backbone of America's industrial might is her power to mass produce, to create more and better things at lower cost. Modern mass production, involving the highly accurate duplication of components, depends in turn on the basic ability to measure with millionth-of-an-inch accuracy. This ability is, to a great degree, the result of Pratt & Whitney's establishment of the standard inch, accurate to millionths, and the creation of the Standard Measuring Machine nearly 70 years ago.

Today, the highly integrated Pratt & Whitney plant of over 1,060,000 square feet houses a wealth of skill, knowledge and experience. The expert craftsmen and specialists in the several divisions of this unique organization . . . working as a team and with complete interchange of technical knowledge and proficiency . . . design, develop, prove and produce a wide variety of Pratt & Whitney precision Machine Tools, Cutting Tools and Gages . . . the finest ever made to meet the exacting demands of industry.

Extreme accuracy . . . to a degree once believed impossible . . . is today a vital industrial necessity in both small shops and huge production plants. And always, your ***First Choice For Accuracy*** is Pratt & Whitney.

PRATT & WHITNEY

DIVISION NILES-BEMENT-POND COMPANY

WEST HARTFORD 1, CONNECTICUT, U. S. A.

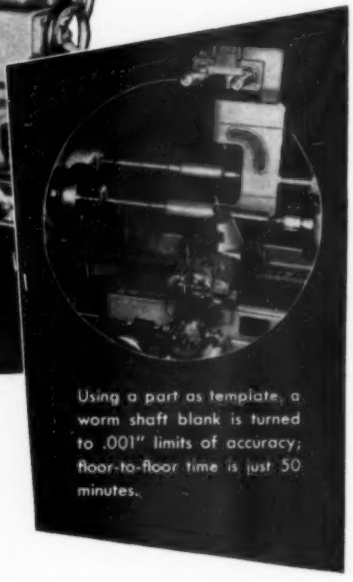
First Choice for Accuracy

BRANCH OFFICES . . .

LODGE & SHIPLEY *COPYMATIC*

Saves 40% to 70% time

on 28 different shaft jobs



Using a part as template, a worm shaft blank is turned to .001" limits of accuracy; floor-to-floor time is just 50 minutes.

. . . at Bay City Shovels Inc., Bay City, Michigan

In analyzing user reports on the Lodge & Shipley COPYMATIC the same two words pop up again and again: "time saved!" This particular user, a well-known power shovel manufacturer, found the COPYMATIC saved up to 70% in time on a wide variety of jobs.

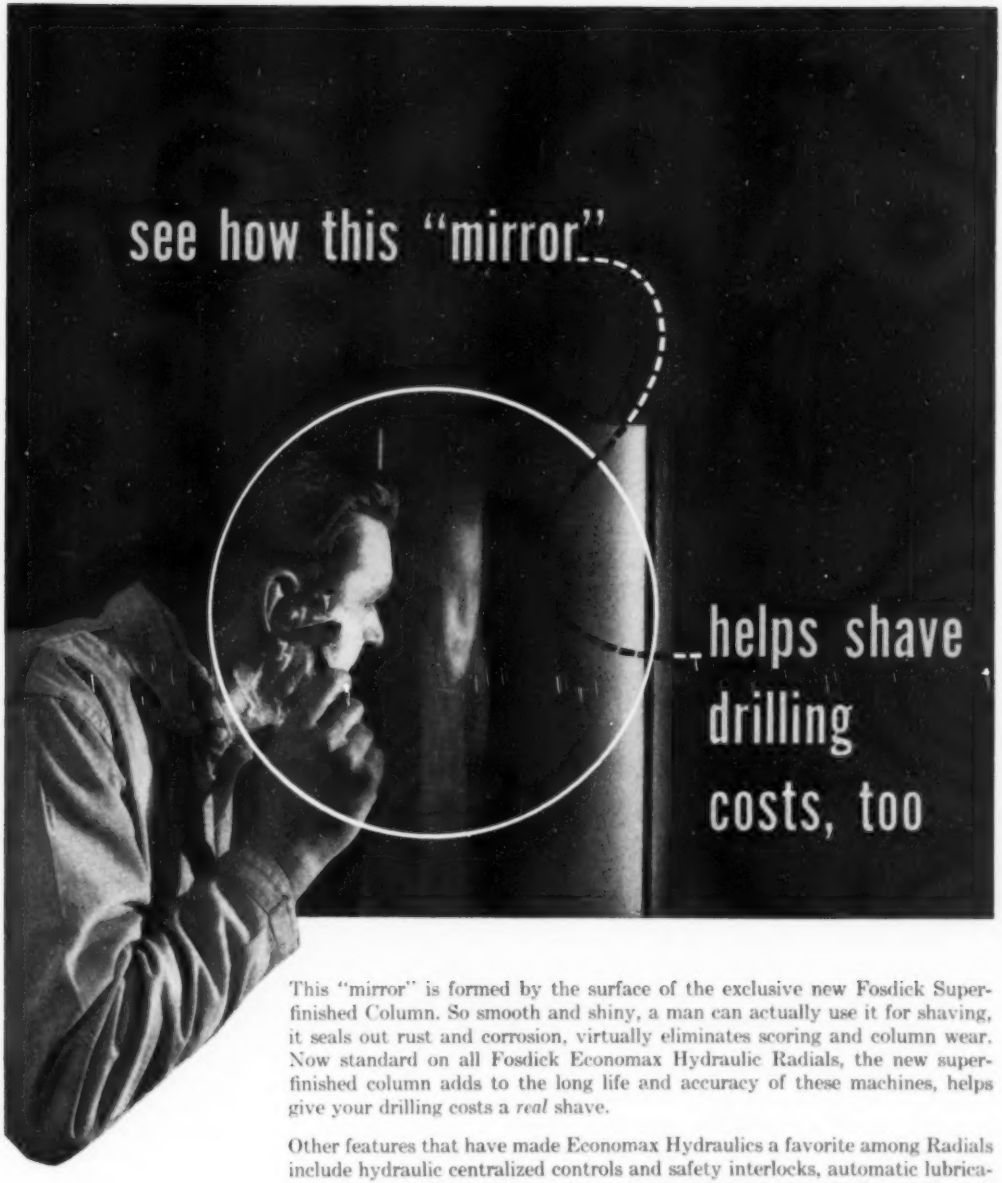
Other expressions of COPYMATIC superiority are mentioned regularly: "wonderful for tapers and contours . . . very easy to operate . . . very accurate," as stated by Bay City Shovels Inc.

The "well done" reports of large and small shops using the COPYMATIC may point up to you similar profit possibilities . . . whatever your product or size of operations. Model "X" engine lathe versatility with the speed and convenience of hydraulically-controlled duplication is a profitable combination for almost any user.

Would you like further information, an explanation of how much the COPYMATIC can save you?
Write today for Bulletin No. 675 and case histories.

THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3059 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO



This "mirror" is formed by the surface of the exclusive new Fosdick Superfinished Column. So smooth and shiny, a man can actually use it for shaving, it seals out rust and corrosion, virtually eliminates scoring and column wear. Now standard on all Fosdick Economax Hydraulic Radials, the new superfinished column adds to the long life and accuracy of these machines, helps give your drilling costs a *real* shave.

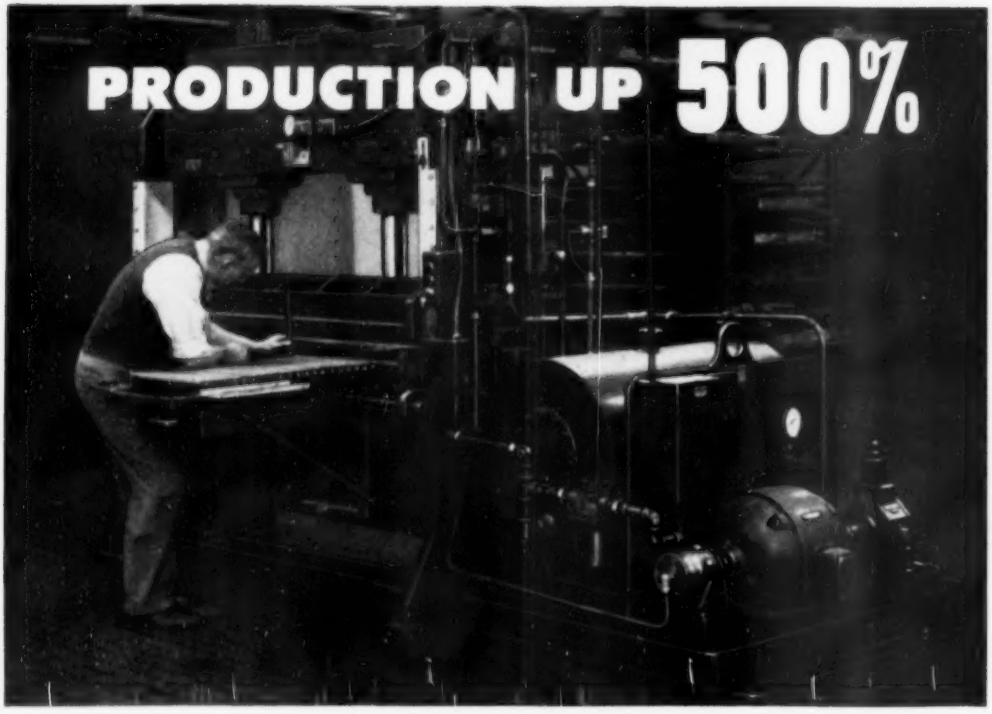
Other features that have made Economax Hydraulics a favorite among Radials include hydraulic centralized controls and safety interlocks, automatic lubrication, the hydraulic non-twist column clamp and many more. Call your Fosdick Distributor today for the whole story or write for Bulletin RDA.

RADIAL DRILLS
SENSITIVE AND UPRIGHT DRILLS
JIG BORERS

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

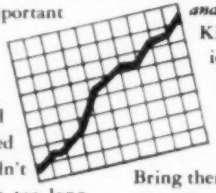
AUTOMATIC POSITIONING MACHINES
SENSITIVE RADIAL DRILLS

FOSDICK



KRW HYDRAULIC PRESS UPS ASSEMBLY OUTPUT 500% AT HOPE'S WINDOWS INC.

The KRW press shown above is curing a big headache! Originally, because of the precise nature of the work, one of the most important assembly jobs at Hope's Windows, Inc., Jamestown, N. Y., was a hand operation. It was slow, painstaking work and held up production of completed Hope's windows. Then the company tried the job on a mechanical press. This didn't work out because the stroke was much too long and, of course, could not be adjusted. Finally, Hope's found the perfect answer to their problem in this 60 ton, 2 cylinder KRW Hydraulic Press.



They set the stroke to $1\frac{1}{2}$" — just what they needed. Result? *Every assembly job is perfect and production has increased five-fold.* The KRW Press cost 2/3 less than the mechanical press that would do the same job — AND the KRW Press can be used extensively for other production jobs through a simple stroke adjustment! Any pressing problems in your work? Bring them to K. R. Wilson for fast, low-cost solution. One, two and three cylinder models; 25 to 150 ton capacities; hand operated, air operated or motor driven. Or, if you need a custom-designed press, we'll build it for you.

For facts, prices and delivery dates see your Machinery dealer or write, wire or phone Dep't. 11

K · R · WILSON

215 MAIN STREET · BUFFALO 3, N. Y.

Operators acclaim it as a money maker!

Wherever operators enthusiastically acclaim a feature as a money maker for them it automatically follows that it is likewise a money maker for the owners.

The direct reading speed control of "AMERICAN" Pacemaker Lathes is a real money maker and operators freely admit it. It makes their work easier; they can secure the right speed quicker; they produce more work because of it and, what is of paramount importance, the pay roll dollar buys more as a consequence.

The direct reading speed control unit shows at a glance the available speeds and the simple means of securing them. Imagine 27 spindle speeds being secured through only two conveniently placed direct reading levers without having to refer to index plates or having to retain lever positions in mind.

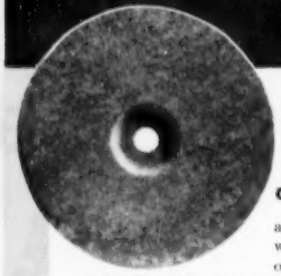
Furthermore, the simplicity of this mechanism and the infinitesimal time required to make speed changes inspire operator confidence and encourage him to make changes necessary to secure correct cutting speeds.

This and other fine features of the "AMERICAN" Pacemaker are thoroughly illustrated and described by Bulletin No. 16.

THE AMERICAN TOOL WORKS CO., Cincinnati, Ohio, U. S. A. LATHES AND RADIAL DRILLS

NORTON PORTABLE GRINDING WHEELS
CUT YOUR WELD GRINDING COSTS BECAUSE THEY...

Hug That Work!



FASTER GRINDING, LONGER WHEEL LIFE AND LESS OPERATOR FATIGUE add up to big savings when Norton wheels take over your weld grinding jobs. They *hug that work* . . . stay in more continuous contact. Less vibration . . . less bounce! This means more metal removed per man-hour. And the complete Norton line makes it possible to handle *any* and *all* weld grinding jobs.

Take this Norton REINFORCED Hub Wheel for example. It's the new, flexible Type BFR Lighter and easier to handle than a 6" flaring cup, longer lasting than a coated abrasive disc, it cuts fast and clean without loading. Made of sharp, durable ALUNDUM* abrasive, special resinoid bond and layers of strong fabric reinforcement, it lasts two to three times longer than similar wheels, according to many plants. For the jobs that require greater stock removal, there's the more rigid Type BD.

Ask your nearby Norton distributor about Norton portable wheels for weld grinding. He's listed under "Grinding Wheels" in your classified telephone directory. Or write direct to Norton Company, Worcester 6, Mass. Distributors in all principal cities. EXPORT: Norton Behr-Manning Overseas Inc., Worcester, Mass., New Rochelle, N.Y.

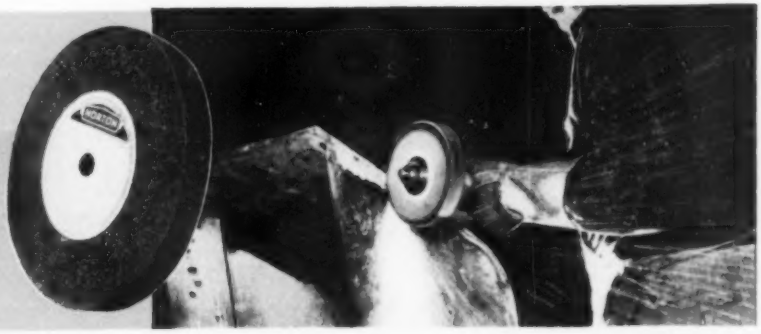
*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON ABRASIVES

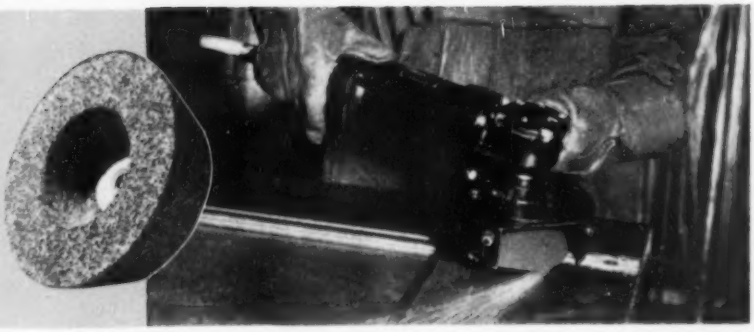
Making better products

Other work-hugging Norton portable grinding wheels are cutting weld grinding costs on jobs like these

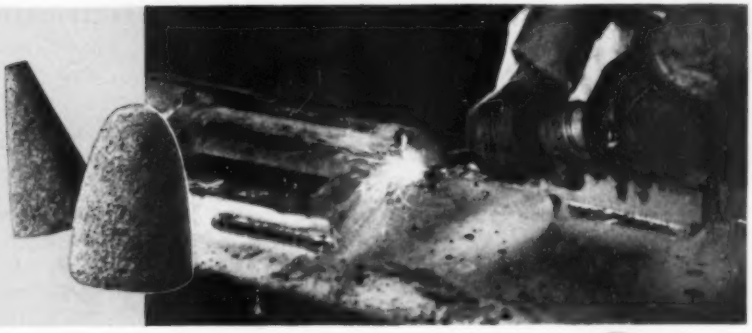
NORTON STRAIGHT WHEEL here grinds butt weld of fabricated machine base with minimum effort on the operator's part. *Controlled uniformity* and *built-in balance* make this wheel hug that work.



NORTON FLARING CUP makes fast work of a weld on a steel door. This wheel is made of Norton ALUNDUM abrasive, the toughest, strongest abrasive you can use.

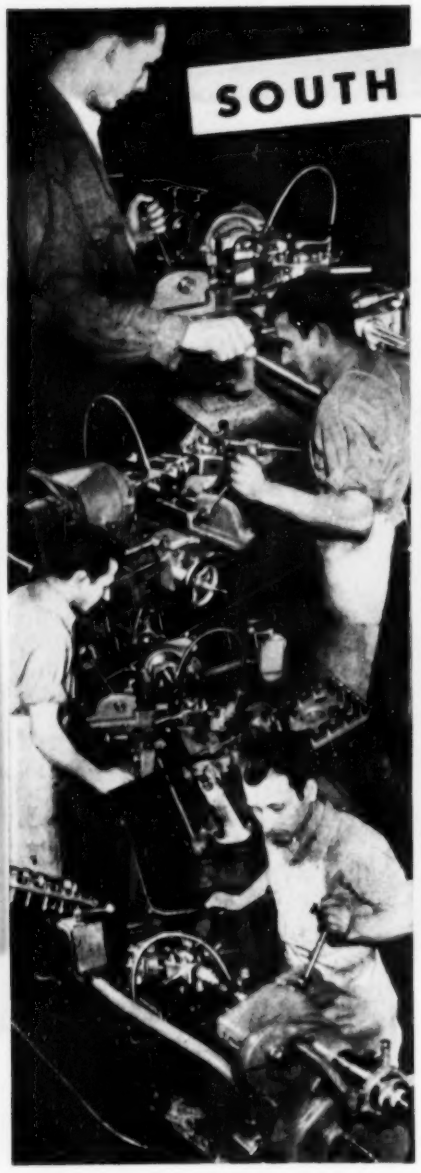


NORTON CONE WHEEL smooths up weld on a fabricated machine base. It's the special Norton resinoid bond that makes wheels like these stay on the job longer.



to make other products better

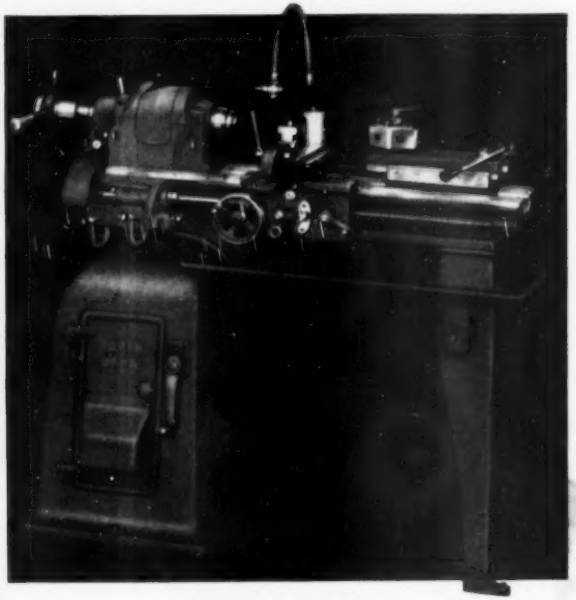
GRINDING WHEEL INSTITUTE MEMBER



SOUTH BEND 1000 TURRET LATHE

Cost-Cutting Versatility

This precision turret lathe will cut your machining costs on small parts. Built-in accuracy, ease of operation and a wide range of speeds and feeds insure high production and close tolerances. Practical attachments simplify tooling the lathe for jobs which might otherwise require special fixtures. What's more, your least experienced operator will soon be a top producer on the 1000 Turret Lathe — it's that easy to run. Find out how this versatile turret lathe can improve your machining — *send coupon now.*



SPECIFICATIONS

Swing	10-1/8"
Turret to Spindle	19-3/8"
Collet Capacity	1"
Spindle Bore	1-3/8"
Spindle Speeds	12
	50 to 1357 r.p.m.
Power Longitudinal Feeds	48
	.0015" to .0836"
Power Cross Feeds	48
	.0006" to .0309"
Thread Cutting Feeds	48
	4 to 224 per inch

AIR NATIONAL GUARD PROTECTS AMERICA

SOUTH BEND LATHE
South Bend 22, Indiana
Building Better Tools Since 1906

Send Information Checked:

☐ _____ ☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ ½" and 1" Collet TURRET LATHES ☐ 14" DRILL PRESSES ☐ 7" BENCH SHAPERS

Name _____ Company _____

Street _____ City & State _____

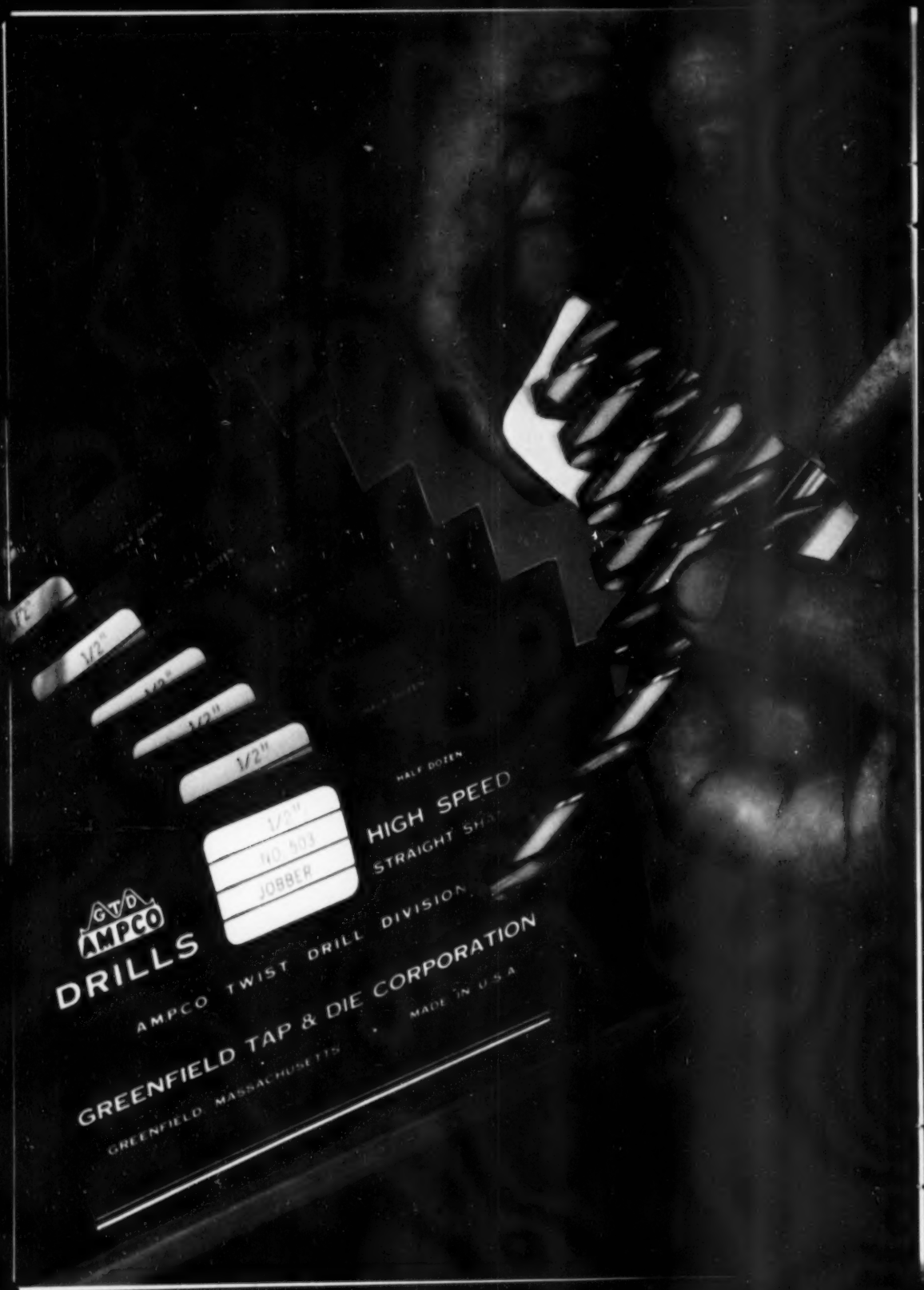
NOW HE KNOWS IT'S RIGHT. "He" could be a final or process inspector, a foreman or a tapping machine operator . . . anyone at a key point on the production line.

But, he could also know when all is **not** well. This gage could warn of a dull tap, a drill going wrong, misalignment in a set up. All these and other faults can be detected by proper gaging.

Know that it's right. Prevent waste. Use good gages!

GREENFIELD TAP and DIE CORPORATION

GREENFIELD MASSACHUSETTS


1/2"
1/2"
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1/2"
HALF DOZEN
1/2"
NO. 503
JOBBER
HIGH SPEED
STRAIGHT SHA
GTD
AMPCO
DRILLS
AMPCO TWIST DRILL DIVISION
GREENFIELD TAP & DIE CORPORATION
GREENFIELD, MASSACHUSETTS
MADE IN U.S.A.

That's All the Cleaning an Allis-Chalmers TEFC Motor Ever Needs

MAINTENANCE COSTS ARE LOW for users of Allis-Chalmers Totally-Enclosed, Fan-Cooled Motors. They are easy to clean because even the stickiest dirt can be wiped or blown off without dismantling the motor or even stopping it. They seldom require cleaning because cooling air flows over the *outside* of the motor. There are no external concealed air passages to clog up and cause over-heating. You get better operational continuity, lower maintenance.

Bearings Save Maintenance, Too

Double-shielded ball bearings require no regular maintenance under most normal operating conditions. Yet if difficult service makes re-lubrication desirable, it can be done without dismantling the motor or bearings. Rigid cast iron frame and stiff end brackets maintain bearing alignment . . . assure maximum bearing life.

A-3639

Texrope and *Vari-Pitch* are Allis-Chalmers Trademarks.

Get The Full Story Now

Your Allis-Chalmers Authorized Dealer or District Office can give you complete information on Allis-Chalmers Totally-Enclosed, Fan-Cooled Motors and how they can save you money. Call one of them today or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B7225.

Sold . . Applied . . Serviced . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ½ in. to 72 in. discharge and up.

ALLIS-CHALMERS

They're back in the States again...

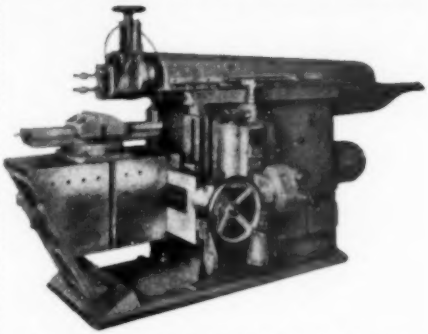
Same KLOPP High-Speed Shapers that cost so little to buy... so little to run, yet turned out so much production!

Klopp Shapers are no strangers to the ways of American mass-production. Many pre-war machines are still on-the-job here at leading metal-working plants, cutting down production costs and stepping up output to keep pace with today's accelerated demands. Several models were demonstrated and sold at the recent Tool Engineers Show in Chicago, because machinists were quick to appraise the unusual speed and flexibility of these lower-priced shapers.

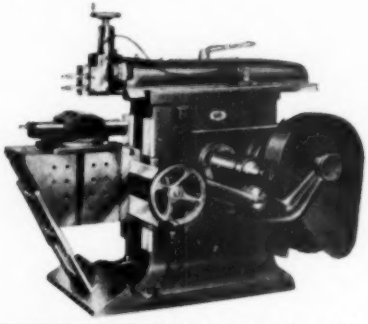
On the Klopp machine, awkward-to-handle, bulky workpieces are easily accessible and simple to set up—because the *head travels to the work*. They're built for high-speed, by Europe's largest manufacturer of shaping machines – at Klopp's fully integrated plant in West Germany—where the complete machines, including all their components from castings to electric motors, are produced.

Write for names of prominent Klopp users. And ask us to quote on your requirements.

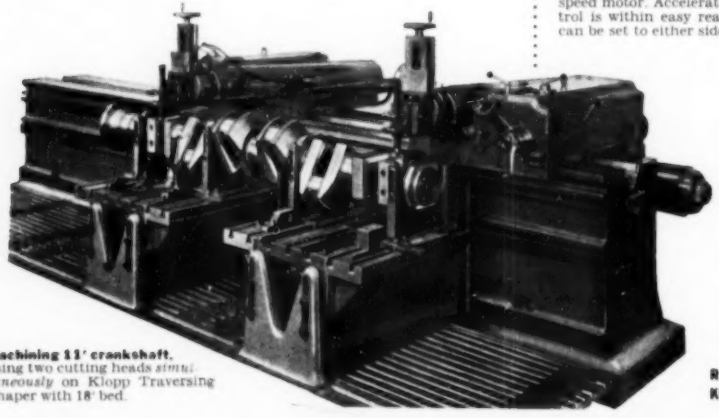
15 Different Models for Immediate Delivery



4 FULLY HYDRAULIC MODELS—stroke lengths from 26" to 39½". Infinitely variable ram speeds with quick return and minimum power consumption. Central operator control panel. Tool holder with graduated scale swivels 45° to either side. Self-acting downfeed of tool slide. Automatic tool lifting device available.



4 MECHANICAL SHAPERS—stroke lengths from 11¾" to 26⅝". Six rates of speeds with normal motor, 12 with two-speed motor. Accelerated return motion. Single lever control is within easy reach of operator. Swivel work table can be set to either side at an angle up to 90°.



Machining 11' crankshaft, using two cutting heads *simultaneously* on Klopp Traversing Shaper with 18' bed.

7 TRAVERSING TYPES—stroke lengths up to 39½"—handle workpieces 6' to 18'. Larger models have two cutting heads which can be brought to the work. Using single point tool, traversing type is capable of faster, more economical production of work usually machined on a planer, plus bulky pieces beyond normal planer capacity.

Replacement parts will be available at Kurt Orban Service Center in Cleveland.

KO EQUIPMENT INC. INDUSTRIAL IMPORTERS

KURT ORBAN

COMPANY, INC.

205 East 42nd St., New York 17 • 4220 Prospect Ave., Cleveland 3 • 19450 James Couzens Highway, Detroit

Canadian sales by European Machinery Ltd., 11 King St. West, Toronto, Canada

First & Finest!

Jones & Lamson Radial Chaser Die Heads

GROUND with THREAD CHASERS

These Die Heads will do an outstanding job on large or small lots, in pitches ranging from extremely fine to coarse multiple Acme.

They are versatile tools with an over-all capacity of from No. 8 to 4¼".

They require no more than the proper chasers to cut either right- or left-hand threads. No extra equipment is needed.

They are easy to install and simple to handle. For almost half a century J&L Dies and Chasers have been the answer to a multitude of threading jobs throughout the world.

Look at these features that make them leaders in their field and give you better threads at lower cost:

STRENGTH

Every part is of solid steel, hardened and precision ground. There are no built-up sections. Dependability and ultimate capacity are assured.

FLOAT

All models are built with both concentric and longitudinal float.

DUAL-DIAMETER CONTROL LEVER FOR ROUGHING AND FINISHING CUTS

Heavy rough cuts, followed by light, accurate finish cuts can be taken with the same set of chasers by merely moving the roughing attachment lever. This is often a chaser saver on heavy, coarse pitch jobs, especially where short chamfers are a requirement.

SIZE ADJUSTMENT

The external micrometer adjusting screw provides simple and precise setting to exact pitch diameter. It is easy to set and maintain sizes well within your thread tolerances.

RAPID CHASER CHANGE-OVER

Chasers are removed for resharpening, or size replacement, by merely removing the front cover of the Die. No tools are required. Change-over is a matter of seconds — which means more hours available for production.

Write to Dept. 710 for illustrated catalog and complete information.

Die Head Division

JONES & LAMSON J&L®

MACHINE COMPANY

Springfield, Vermont, U.S.A.

Machine Tool Craftsmen Since 1835

Is your present abrasive method

Only CARBO TRADE

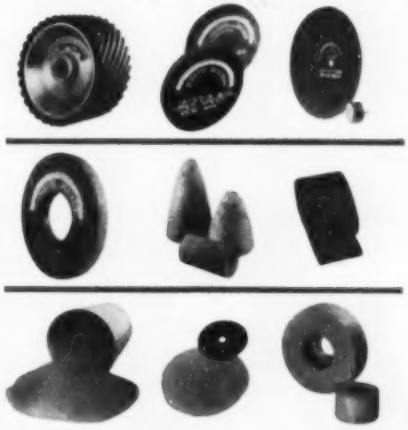
"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, New York

really good enough, today?

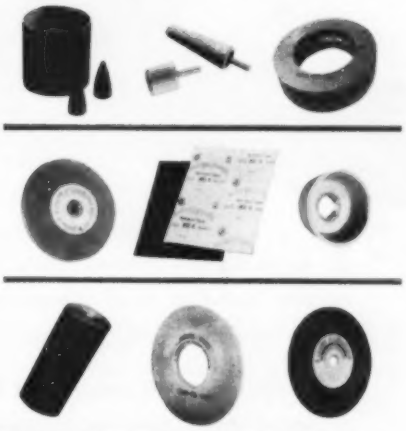
Chances are good that if you've been using the same method for a mere two years, there's now a better way. That's how thick and fast the new developments in abrasive techniques have come along. Every day someone, somewhere, is switching from one method to another, under the pressure of one hard economic fact: the need to cut costs.

Here lies the biggest advantage to the shop which has standardized on abrasives by CARBORUNDUM. You get counsel free from bias, for the CARBORUNDUM distributor or salesman represents the only producer of a complete branded abrasives line, famous for uniform high quality. Thus he can recommend on the basis of what's most profitable for you, not just what's most profitable for him. And he can keep you posted on all the newest practices of metalworking shops from coast to coast.

Make a mental run-down today of each abrasive operation your shop performs, then call in the man from CARBORUNDUM for his experienced, practical, unbiased counsel. You'll find him listed in the yellow pages under "Abrasives." Call him today—it's to your profit!



Here are only a few of the 30,000 reasons why you get the RIGHT combination of abrasive and method only from CARBORUNDUM



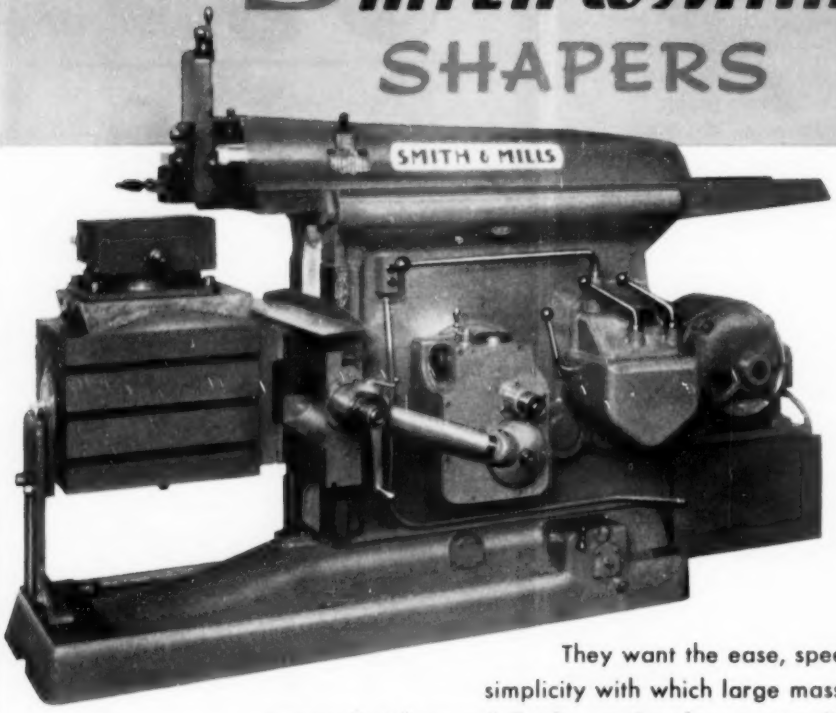
RUNDUM

MARK

offers ALL abrasive products...to give you the proper ONE

After 64 Years - Operators Still Want

Smith & Mills SHAPERS



They want the ease, speed and simplicity with which large masses are removed with smooth finish — and such operating features as solid ram — ram position adjustment — simple speed selection — quickly handled feed mechanism — fast, easy stroke setting — power rapid traverse — and the combination of brute strength and sensitivity.

Management, too, wants Smith & Mills' low maintenance costs and minimum down time for heavy metal cutting production jobs and their extreme precision tool room work.

The Smith & Mills COMPANY

affiliated with Bryant Machinery & Engineering Company

General Office: 400 West Madison Street, Chicago 6

EXCLUSIVE REPRESENTATIVES THROUGHOUT THE WORLD

Fine Shapers since 1888

HARDINGE-SJOGREN

HARDINGE
ELMIRA, N.Y.

SPEED

Collet Chucks with

HARDINGE STEEL COLLETS

Available in Five Sizes:
1", 1⅜", 1¾", 2¼", and 3½" collet capacity.

for Accuracy and Durability at Low Cost

When you order Hardinge-Sjogren Chucks and Hardinge **Steel** Collets you get all these advantages:

1. Complete Capacity for Hexagon and Square as well as Round.
2. Lowest Initial Cost.
3. Longest Service Life.
4. Grips both **short** and long lengths properly.

. . . . . and HARDINGE tempered steel collets assure you of quick release, sustained accuracy and durability.

Write for Bulletin 8— complete information on

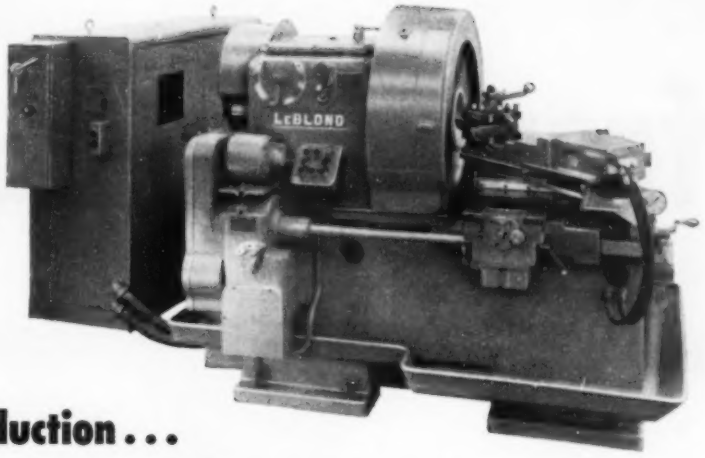
HARDINGE-SJOGREN Chucks and Collets.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

ANNOUNCING THE NEW LEBLOND

CONTOUR FACING LATHE!



Now in full production . . .

Automatically faces jet engine turbine wheel discs . . .

New design from the ground up.

High-speed automatic contour facing, semi-finish or finish.

Flexible, with ready accessibility for changeover from one disc to another.

For either steel or aluminum.

Fully automatic cycle to center *or* across center.

Automatically-controlled constant cutting speed.

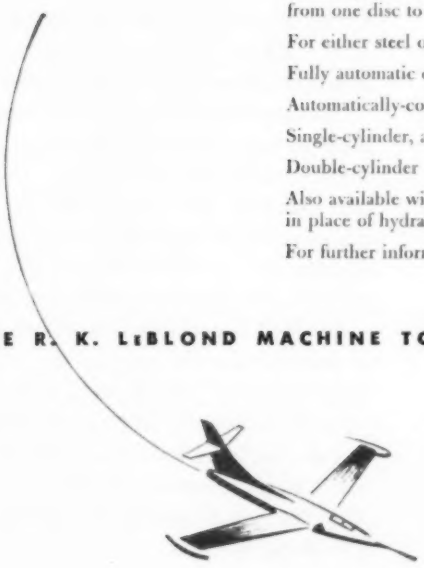
Single-cylinder, adjustable-angle Hydra-Trace for simple discs.

Double-cylinder tracer for complicated discs.

Also available with power angular feed compound rest in place of hydraulic tracing unit.

For further information write . . .

THE R. K. LeBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

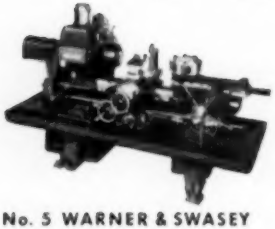


LeBLOND of Cincinnati

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 64 YEARS*

from 2" to ½" with

¾" depth of cut on No. 5 Warner & Swasey holds limits of ±.001"



No. 5 WARNER & SWASEY

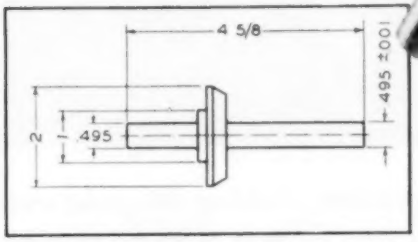
The O. C. Keckley Company, Chicago valve manufacturer, machines the Valve Stem of their Type 410 Stainless Steel Valve, reducing the diameter from 2″ to ½″ with *one* pass of a Warner & Swasey Single Cutter Bar Turner. Spindle speed is 274 RPM, Feed: .012″. The limits on this operation are ±.001″.

You must have the best in machine tools to turn out jobs like this. Power, alone, is not enough. The machine and tools must be designed to provide maximum rigidity for heavy carbide cuts, as well as to have a surplus of power.

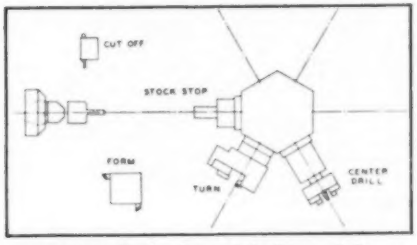
Keckley found out that Warner & Swaseys are the answer to their problem jobs. Why not see what Warner & Swasey Turret Lathes can do for you? Call your nearest Field Representative or write The Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS . . . WITH WARNER

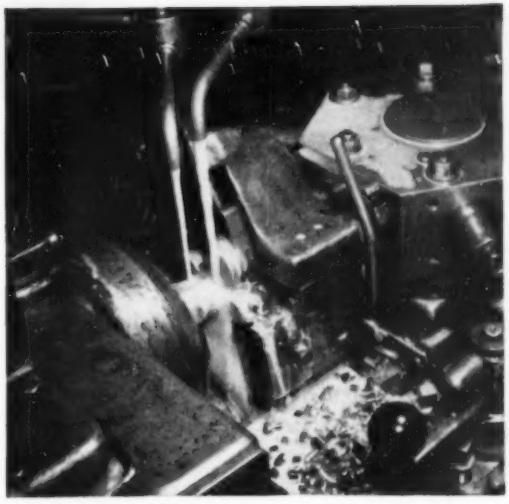
one cut!



THE PART—*Type 410 Stainless Steel Valve made by O. C. Keckley Co.*



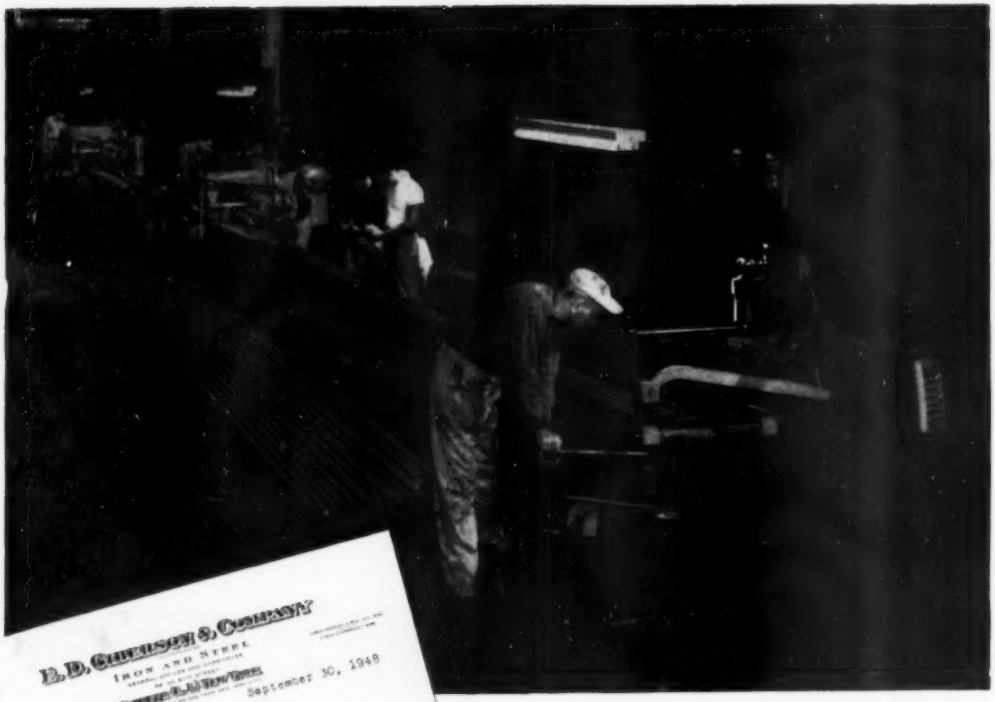
THE METHOD—*Tooling Setup of the Warner & Swasey No. 5 Turret Lathe that produces this part. Standard Tools are used.*

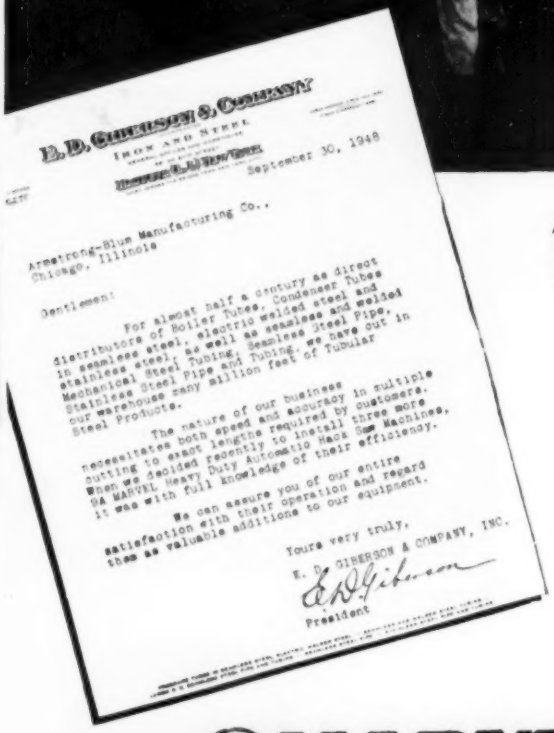


THE OPERATION—*Diameter of 2" bar is reduced to ½" in one cut, and .001" limits are held.*

WARNER & SWASEY
Cleveland

& SWASEY TURRET LATHES, AUTOMATICS AND TAPPING MACHINES





E. D. GIBERSON & COMPANY
IRON AND STEEL

September 30, 1948

Armstrong-Blum Manufacturing Co.,
Chicago, Illinois

Gentlemen:

For almost half a century as direct distributors of Boiler Tubes, Condenser Tubes in seamless steel, electric welded steel and stainless steel, as well as seamless and welded Mechanical Steel Tubing, Seamless Steel Pipe, Stainless Steel Pipe and Tubing, we have cut in our warehouse many million feet of Tubular Steel Products.

The nature of our business necessitates both speed and accuracy in multiple cutting to exact lengths required by customers. When we decided recently to install three more 9A MARVEL Heavy Duty Automatic Hack Saw Machines, it was with full knowledge of their efficiency.

We can assure you of our entire satisfaction with their operation and regard them as valuable additions to our equipment.

Yours very truly,

E. D. GIBERSON & COMPANY, INC.

E. D. Giberson
President

Another Tubing Warehouse "Goes MARVEL"

Warehouses that are not equipped with proper sawing machines find that the cutting of steel tubing (especially the stainless types) is a difficult and costly job. But E. D. Giberson & Company, New York, have cut off millions of feet of all types and sizes of steel tubing to accurate lengths, economically and without difficulty, due to the fact that they have long been properly equipped with MARVEL SAWS. And because they have found MARVEL SAWS so trouble-free, so reliable, so economical to operate and so universally suited to all their cutting-off jobs, they have recently added this row of three new MARVEL No. 9A Automatic Hack Saws. With this additional equipment, they have expanded their facilities and can more promptly serve their fast-growing list of satisfied customers with steel tubing of all types and sizes, "cut to customer's specified lengths."

The local MARVEL Field Engineer will be glad to study your range of cutting-off work—whether it be in pipe, structural shapes, bars, or the toughest and largest alloy billets—and will then make recommendations on how you can improve your cutting-off operations to reduce costs and increase man-hour output.

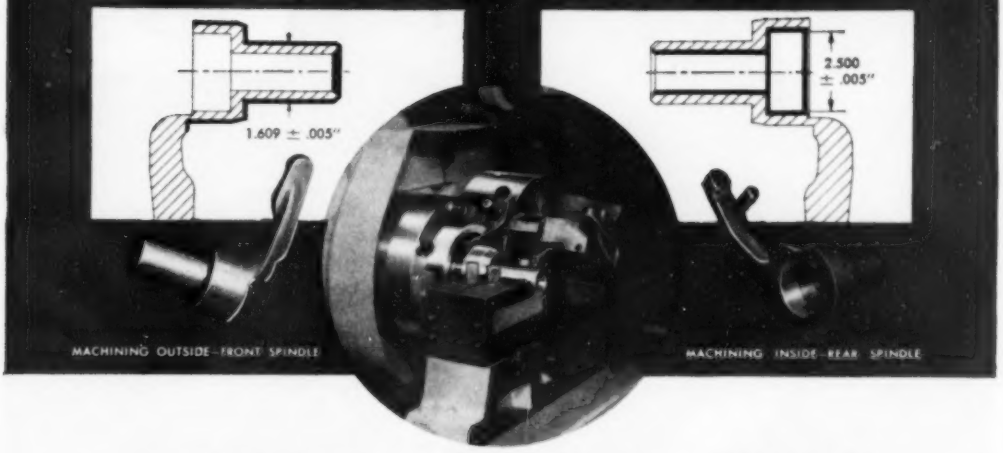
Just write us on your letterhead: "Without cost or obligation on our part, send your local Field Engineer to look over our cutting-off operations."

Metal Cutting
MARVEL SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. COMPANY

5700 WEST BLOOMINGDALE AVENUE "The Hack Saw People" CHICAGO 39, ILLINOIS

THIS FORGING IS *COMPLETELY* PRECISION-MACHINED IN *ONE* AUTOMATIC TURRET CYCLE

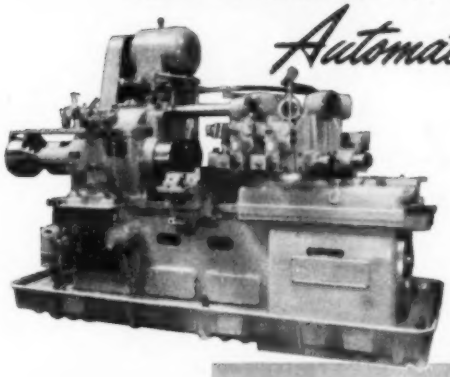


2 SPINDLES--ONE POWER SOURCE

PROVIDE INCREASED PRODUCTION AT LOWER COSTS

THE POTTER & JOHNSTON 5D-2

Automatic Turret Lathe

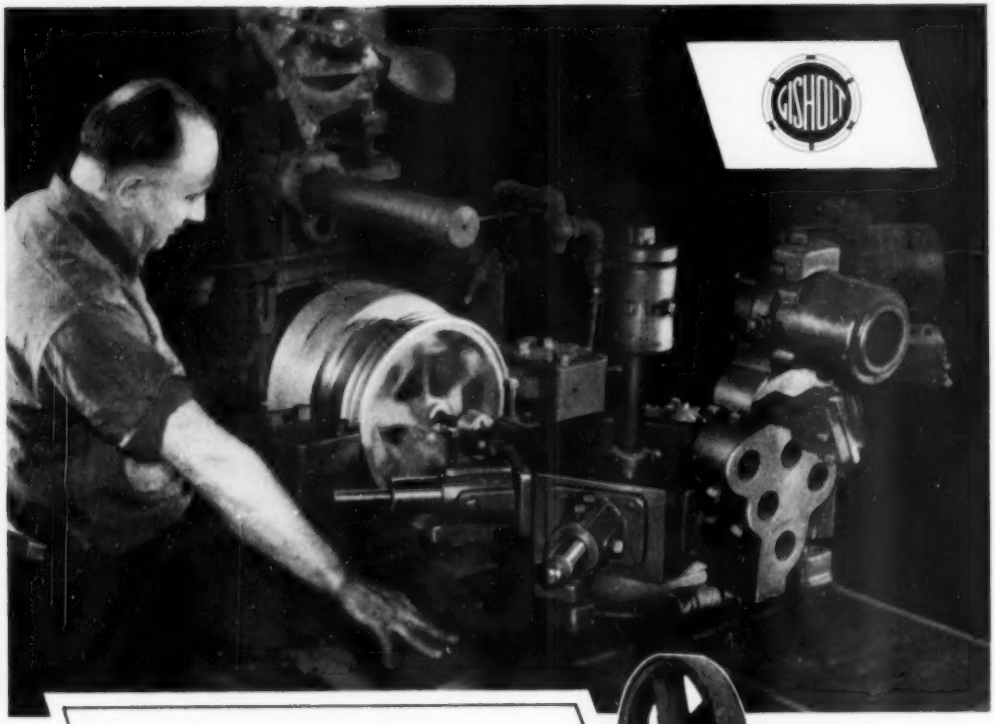


Designed to meet today's requirements for increased production of precision-machined work, the Potter & Johnston 5D-2.9" machine is equipped with a double spindle headstock and provides two tool stations on each turret face. It is now possible to perform an operation on two parts simultaneously, or an operation can be performed on one part while supplementary work is, at the same time, being done on a second. Output is far greater than the best obtainable from one single spindle unit. Initial cost, power consumption, floor space and operator attention are all much less than that required for two single spindle machines; production costs are lowered substantially.

Complete information about the 5D Automatic Turret Lathe including dimensions, specifications and design data will be sent on request. If desired, P&J tooling recommendations and time estimates based on your own sample parts or prints will gladly be furnished.

POTTER & JOHNSTON
COMPANY
PAWTUCKET, RHODE ISLAND

SUBSIDIARY OF PRATT & WHITNEY P&J DIVISION NILES • BEMENT • POND CO.



Production Trebled by the *FASTERMATIC!*

Rough Casting

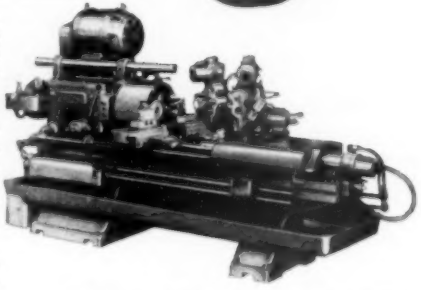
Finished Sheave

Note here the rather simple tooling arrangement for machining cast iron sheaves. This setup, similar to regular turret lathe work, is made just as easily. But here, the machine performs 15 different operations—holds tolerances consistently—completes the entire machining job in 13 minutes. The former time was 59 minutes.

Completely Automatic Cycle

It's the swift, automatic cycle of the Fastermatic that accounts for such substantial time savings. With its hydraulic feed system and automatic speed control, the operator has only to load the chuck, start the machine and remove the finished work. Usually, the operator has time to tend a second machine.

Now, when you need still greater production, it is a good time to look into the Fastermatics. Write for the Fastermatic catalog.



THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

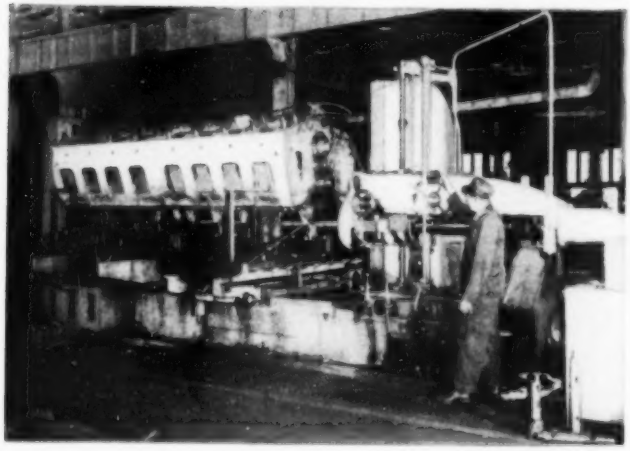
The Fastermatics are universal automatic turret lathes. Designed for accurate, high production turning, they can also be economically used on comparatively small lot work.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

a Boring plus Performer*



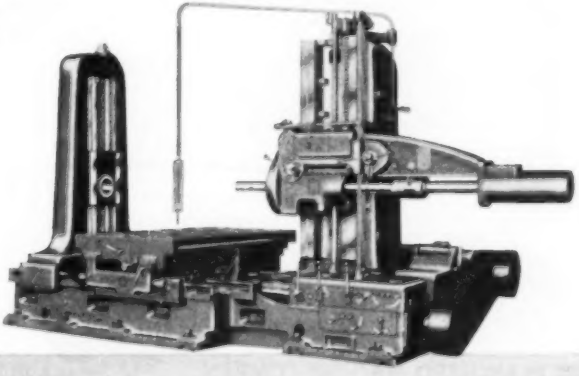
FOR Diesel CRANKSHAFT BEARINGS

* And Now
BETTER PERFORMANCE
with

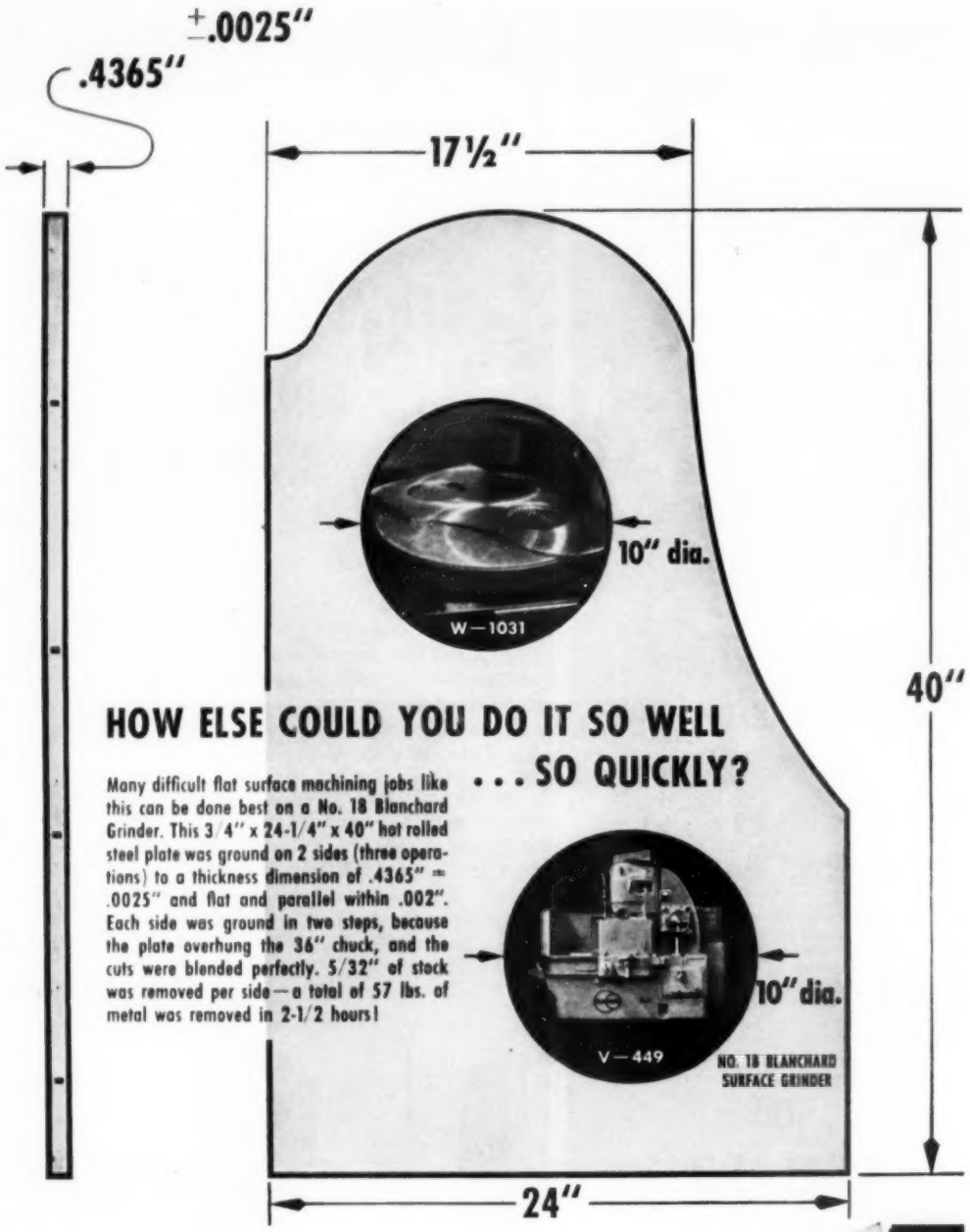
1. Broad Rigid 4-WAY bed
2. Heavier box type saddle and table.
3. Motor-driven lubricating pump for the gear boxes.
4. Improved hydrodynamic main drive.

Here is a typical example of the adaptability of the Horizontal Boring Machine for a wide range of Diesel shop requirements. This 5" machine, installed in a large mid-western shop in 1946, is shown boring a Diesel frame for crankshaft bearings using a 6" dia. x 16' bar and employing five tools at the same time. It has been used exclusively for this work for the past two years.

The new redesigned Bullard Horizontal Boring Machine is equipped to provide still higher standards of maintained accuracy and more versatile performance. The new heavier design, features a massive 4-WAY bed, motor-driven lubricating pump for the gear boxes, improved hydrodynamic main drive and other important improvements. Write for complete details or better still, have a Bullard man tell you what a Bullard Horizontal Boring, Milling and Drilling Machine can do for you in your own shop.



THE BULLARD COMPANY
Bridgeport 2, Conn.



HOW ELSE COULD YOU DO IT SO WELL . . . SO QUICKLY?

Many difficult flat surface machining jobs like this can be done best on a No. 18 Blanchard Grinder. This 3/4" x 24-1/4" x 40" hot rolled steel plate was ground on 2 sides (three operations) to a thickness dimension of .4365" ± .0025" and flat and parallel within .002". Each side was ground in two steps, because the plate overhung the 36" chuck, and the cuts were blended perfectly. 5/32" of stock was removed per side—a total of 57 lbs. of metal was removed in 2-1/2 hours!

NO. 18 BLANCHARD SURFACE GRINDER

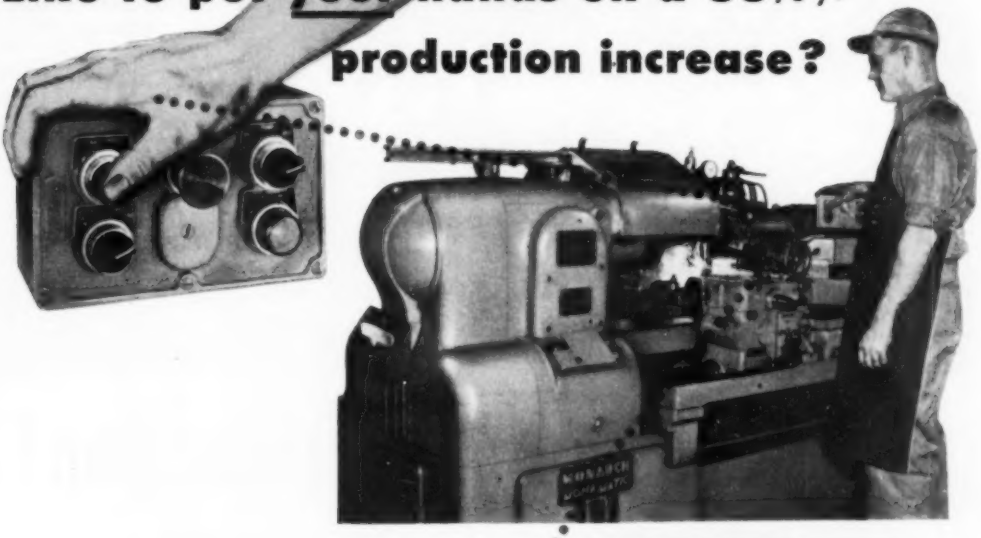
Send for your free copies of "Work Done on the Blanchard," fourth edition, and "Art of Blanchard Surface Grinding."

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

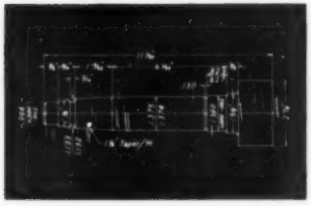
Like to put your hands on a 33⅓% production increase?



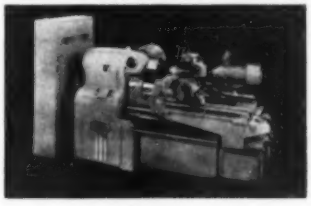
Since the Milwaukee Gear Company installed their first completely automatic cycle Monarch Mona-Matic several years ago, an *overall* turning production increase of 33⅓% has been recorded.

An interesting point is that this machine is used for a large variety of work in relatively small lots—proving again that for accuracy, for rate of output and for ease and speed of setup, the "Air-Gage Tracer" controlled Monarch Mona-Matic just can't be equaled. Now, a second Mona-Matic has been installed by this user. On many jobs, one man can operate both machines, practically doubling the original increases.

Even greater time reductions are recorded here on specific jobs (see details, right). Results like these are typical of all Mona-Matic installations, whether the runs are short or long. The proved efficiency and economy of the Monarch tracer controlled running tool deserves your serious consideration. So let us give you the complete Mona-Matic story. Write for illustrated booklet No. 1804 . . . . . *The Monarch Machine Tool Company, Sidney, Ohio.*



Part—pinion. **Material**—SAE 4615. **Operation**—turn (both rough and finish) from 2⅞" bar stock, using three cuts because of amount of metal which has to be removed. Rear slide tools simultaneously form two necks. **Production Increase**—60% for a run of 320 pieces. This includes setup time and is secured on a *single* Mona-Matic. Because of superior Mona-Matic accuracy, subsequent grinding time is materially reduced.



Monarch
TURNING MACHINES

ACCURACY • ECONOMY • LONG LIFE

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

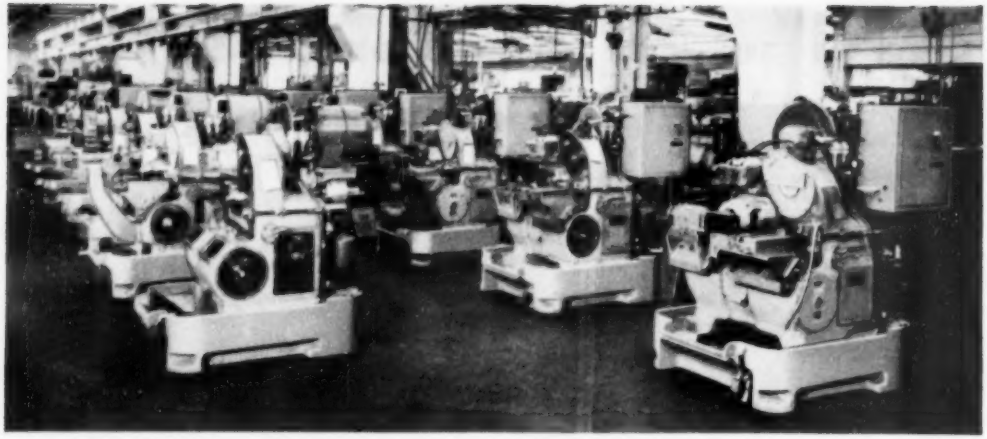
Gentlemen: I am interested in your Mona-Matic story and would like to receive your illustrated Booklet, with complete data and job performance reports. Please send me your Booklet 1804 without obligation.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____



Five times former production!

That's what happens when Chuck-Matics replace hand machine methods for this High-Precision job

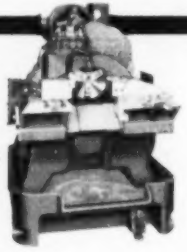
HERE'S THE STORY . . .

Most of the machines in this battery of Chuck-Matics were bought by one manufacturer, to do primary operation jobs—*and do them fast.* And, like many other jobs—such as bearing races, gear blanks and similar short-length parts—this customer's parts are rolling out in record time. The Chuck-Matic literally runs rings around ordinary hand-machine methods. Production increases of two to six times are the usual, rather than exceptional experience.

AND HERE'S THE JOB

PART	Cast-iron Cap
SIZE	$6\frac{5}{8}$" Diameter
OPERATIONS	5
TOOLS	Carbide-tipped
MACHINE TIME	35 Seconds
PRODUCTION	Five Times Former (Hand Machine) Method

—AND HERE'S THE MACHINE—



The 12" ACME-GRIDLEY Chuck-Matic Single-Spindle Chucking Machine.

- Removes metal as fast as carbide tools can take it.
- Versatile in operation; accommodates special machining requirements such as taper boring, internal recessing, relief facing and many other primary operations.
- Easy to set up, accessible for quick changes from job to job.
- Easy to operate; one operator can run as many machines as cycle time of jobs permit.
- Spacesaving; floor dimensions: 45" wide, 64" long.
- Rugged! Powerful! Meets high-precision standards on castings, forgings and tubing parts.

Ask for Bulletin SC-46

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

Faster production at lower cost

New

MODERN COLLAPSIBLE TAPS

FOR EITHER STATIONARY OR ROTARY USE

- Easy and quick adjustment. No special tools required.
- Interchangeable shank for convenience in changing from one machine to another.
- Thread length setting undisturbed by diametrical adjustment.
- Extra rigidity with unusually sensitive collapse.
- Simple in design. No complicated mechanisms.
- Heavy chasers for greater strength. Chaser threads precision ground.
- All parts hardened and ground and precision fitted.

Modern Precision Tools Include . . . . .

STATIONARY SELF-OPENING DIE HEADS
ROTARY SELF-OPENING DIE HEADS
STATIONARY COLLAPSIBLE TAPS
ROTARY COLLAPSIBLE TAPS
MODERN-MAGIC CHUCKS AND COLLETS
SELF-OPENING STUD SETTERS
INSERTED BLADE FACE MILLING CUTTERS
SOLID ADJUSTABLE DIE HEADS
ADJUSTABLE HOLLOW MILLING TOOLS
UNIVERSAL CHASER GRINDING FIXTURES

Send for full information on this new improved Modern Collapsible Top and its cost reducing possibilities applicable to your tapping

MODERN TOOL WORKS

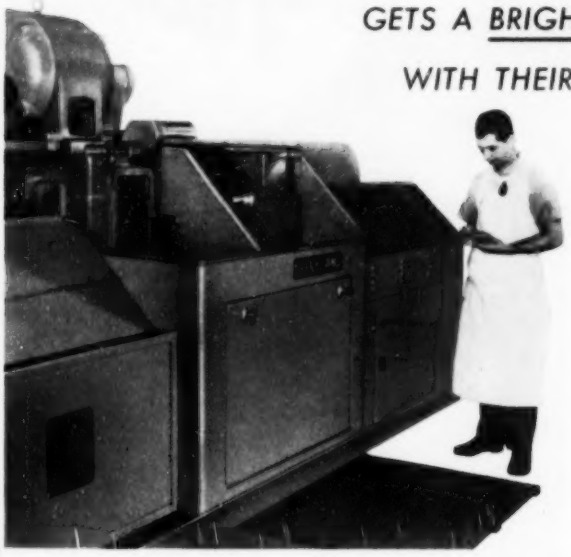
DIVISION OF

CONSOLIDATED MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

FAIRCHILD
CAMERA AND INSTRUMENT CORPORATION

GETS A BRIGHTER PRODUCTION PICTURE WITH THEIR NEW CLEVELAND DIALMATIC



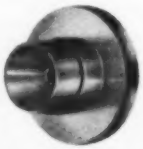
Model AB Cleveland Dialmatic 3" Single Spindle Automatic at Fairchild Camera and Instrument Corp. Shown below are a few of the parts produced, typical of those used in the manufacture of Fairchild Aerial Mapping and Reconnaissance Cameras, Potentiometers and many other precision electrical-mechanical products.

PLUG
2-9/16" dia.
B1113 Steel
1.93 min. per piece

SPUR GEAR
1¾" dia. Aluminum
1.74 min. per piece

SCANNER DRUM FITTING
2⅝" dia.
Aluminum
2.04 min.
per piece

CLUSTER GEAR
2⅜" dia. Aluminum
2.34 min. per piece



PLUG
1⅞" dia.
B1113 Steel
1.20 min. per piece

Fairchild production engineers report *outstanding* time savings on their screw machine parts production with the new 3" Cleveland *Dialmatic*. A comparative study of machining times covering a variety of parts (five of these are illustrated at right) shows that their Cleveland has scored production increases ranging from 82 to 471%.

This Cleveland *Dialmatic* makes full automatic production of short-run jobs *economical*, because set-up time is *short*. Cleveland's exclusive *Electric Feed Drive* operates all five turret tools. Highly accurate forward and return tool feed rates are set simply by turning dials on the control panel. There are *no* cams to change; *no* time-wasting, set-and-try mechanical adjustments necessary. You can *tune* the job to maximum production while the turret tools are cutting.

The Model AB *Dialmatic* is made in 2½" and 3" capacities. There are 112 spindle speeds, from 24 to 1820 r.p.m., available in the 2½" machine; 98 speeds, from 24 to 1402 r.p.m., in the 3" machine. That gives you a broad range of cutting speeds suitable for all metals — all types of tools. And do you have an occasional chucking job to run? The Model AB Cleveland is quickly converted to a *chucker* having 6" swing!

Call in a Cleveland engineer. Let him discuss with you the economies a Cleveland *Dialmatic* can make for your plant. For a quick but complete description of this most versatile of all automatics, write for Bulletin "AB".

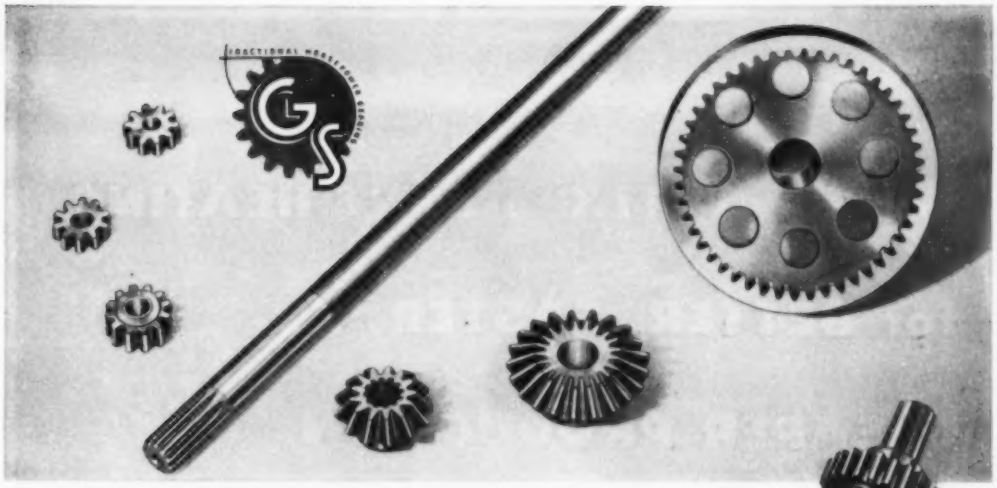
Remember, Clevelands Cut Costs!

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines



LAUSON Outboards Give Top Performance with G.S. Small Gears

"Completely engineered for trouble-free operation"..that's what The Lauson Company, of New Holstein, Wisconsin, says about their newest Model T-651R, 6 H.P. Twin Outboard Motor. Only components uniformly manufactured to the highest precision standards can assure the *consistent* trouble-free operation of this rugged new Lauson Twin. G.S. is pleased with the privilege of making the Fractional Horsepower Gearing for a motor of such excellent quality. We welcome the responsibility of helping Lauson to maintain a 50 year reputation for building better engines.

If you, too, have a quality product in which *better* Small Gears are involved, you can depend upon G.S. for the kind of cooperation you need. Let our highly specialized skills and facilities go to work for you NOW. Will you write for a demonstration of G.S. service today?

SEND FOR..

free new 6-page folder illustrating and describing G.S. facilities, Small Gearing and applications, together with handy charts. Will you ask for it on company stationery, please?

GEAR Specialties, Inc.

Spurs · Spirals · Helicals · Bevels · Internals · Worm Gearing · Racks · Thread Grinding

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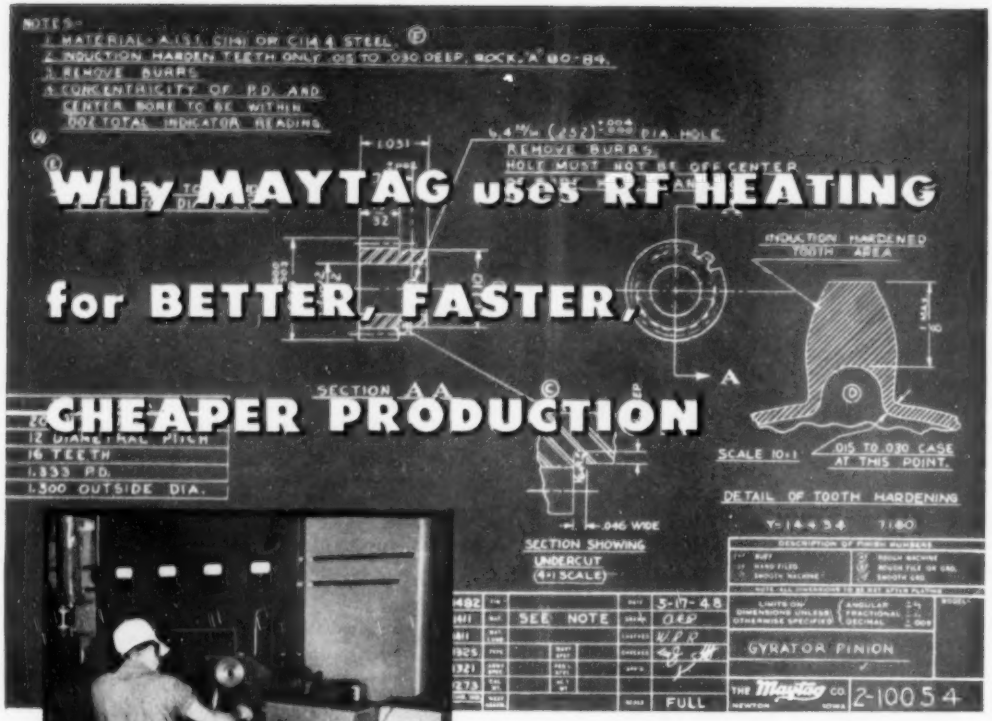
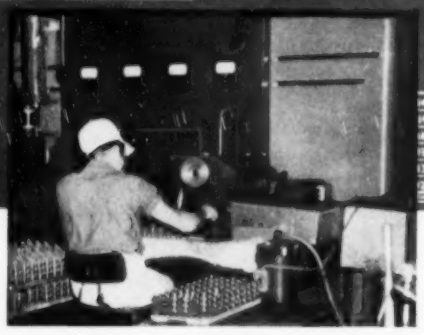
MEMBER OF

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

Why MAYTAG uses RF HEATING for BETTER, FASTER, CHEAPER PRODUCTION





● The Maytag Company has found, for fast production at low cost and high quality, Westinghouse RF Heating installations are the answer.

The installation of a process using two 20 KW-450 generators—for both spline and straight shaft hardening—has paid for itself in *less than 3 months!* This was shortly after World War II, and since then continued use has piled up real profit in savings.

In building a new plant for production of a completely new line of automatic washing machines, Maytag turned to induction heating for brazing and hardening . . . and they specified Westinghouse. A 50 KW and 10 KW RF generator, with associated work handling equipment, are now accounting for still further savings and continued high quality. That's why Maytag says that not only is the Westinghouse RF process the best method for heat treating production parts, but, also, "it produces precision work at the price of rough and ready work."

As we helped Maytag, let us help you solve your problems of increased production at low cost and with high quality. By all means, investigate the possibilities of installing Westinghouse RF Heating.

J-02341

Westinghouse Electric Corporation
Department M-41
2519 Wilkens Avenue · Baltimore 3, Maryland

Send me your informative case history booklet on induction heating.

Name .....

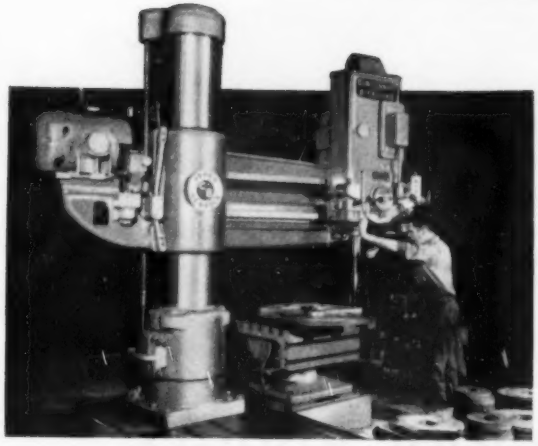
Company .....

Street .....

City ..... Zone ..... State .....

INDUCTION HEATING

Now *one hour's work,* *in* 40 minutes



The Carborundum Company, Niagara Falls, New York, famous manufacturer of abrasive products, has this 6' arm 17" diameter column SUPER SERVICE Radial Drill performing in twenty minutes, operations that previously took thirty minutes. Like many other enthusiastic users of the SUPER SERVICE Radial, these people feel that the savings they are now experiencing with this machine is due to the suitability of this machine for their type of work, and the ease with which the SUPER SERVICE Radial handles.

Notice the use of the strong and accurately built universal table. It is used here on a base extension especially provided so that the main base can remain available for big work. Convenient controls, always within easy reach of the operator, thirty-six speeds and eighteen feeds, combine to make available the right combination for the drilling, tapping, reaming or counter-boring tool involved.

Correct, safe manipulation is easy on the SUPER SERVICE Radial. For further information on the many exclusive features of the SUPER SERVICE Radial, write for Booklet R-29.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

ARMSTRONG

ARMSTRONG TOOL HOLDERS

are more efficient

It takes years of development, improvement and practical experience to create and perfect a line of tools. This has been the specialized work of ARMSTRONG, a contribution to machining efficiency which they have carried on continuously for 59 years.

Starting with the Armstrong Principle of inserted cutters in permanent tool shanks that "Saves: all Forging, 70% Grinding and 90% High Speed Steel," they created this unique method of tooling which has changed shop practice in over 96% of the machine shops and tool rooms. And, today, in a specially built plant, equipped with every modern facility and staffed with experts in each phase of tool making, this work goes on.

To you, as a tool user, here is always one safe principle — specify ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters and shapers, for turret lathes and screw machines. They are cataloged and stocked by all leading supply houses.

Write for Catalog

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 W. ARMSTRONG AVE. CHICAGO 30, U.S.A.

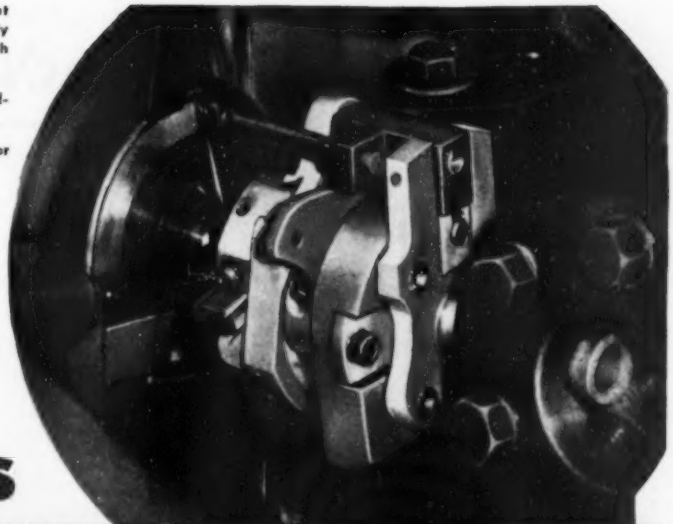
Eastern Whse. & Sales Office: 199 Lafayette St., New York 12, N. Y.

Pacific Coast Whse. & Sales Office: 1275 Mission St., San Francisco 3, California

★ Simple, compact design combines light weight with strength, to function dependably and accurately at high indexing speeds, with long runs between grinds.

★ All important bearing surfaces are hardened and ground and hand lapped.

★ All external surfaces are chrome plated for protection.



JONES & LAMSON
AUTOMATIC OPENING
DIE HEADS

for Brown & Sharpe Automatics and Small Turret Lathe Applications

Designed and built for high production quality threading, these new J&L dies perform with smooth, easy action, unusual repetitive accuracy, and year 'round dependability at low cost. They will give you maximum productive machine hours each day.

No. 16-S is for use on No. 00 and 00G and No. 0 and 0G Brown & Sharpe Automatics and small turret lathes. It uses long wearing ground thread, radial type chasers *with two cutting edges*. These DUALIFE chasers are easily and quickly removed and replaced in their holders. When one edge wears out, just turn them over, and you have the equivalent of a new set of chasers. Minimum down time and maximum production result.

No. 18-S and 19-S Model 18-S is for use on No. 0, 0G and No. 2, 2G Brown & Sharpe Automatics. Model No. 19-S with wider capacity range, is for use on No. 2, 2G Brown & Sharpe machines. Both are also used on small turret lathes. They have Tangent type chasers, ground all over, incorporating the exact helix angle and thread form. They are easily removed and replaced without disturbing the head and holder assembly. Many of these chasers are interchangeable between the two models and other standard J & L Tangent Die Heads. Carbide chasers can be used when conditions permit.

WRITE DEPT. 710 FOR TANGENT AND RADIAL DIE CATALOGS

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U. S. A.

J&L

DIE HEAD DIVISION

Even the smallest size Reamers are Standard with L&I

The Reamer Specialists
LAVALLEE & IDE, INC.
CHICOPEE, MASS.

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Dining Room or Cafeteria

One of your readers asks whether anybody else has run into the problem of the executive dining room (*AM*, Feb 4). Well, we have such a room in our plant, in fact we have two—one for supervisors and one for the top brass—and I can't feel that there is any problem involved.

I work in the shop and I am quite satisfied to sit down in the cafeteria with my friends. The food isn't fancy, but it's good and cheap, and in spite of what they say about high labor rates I can't afford to pay a buck and a half or more every lunch time. I bet a lot of the foremen can't, either, and would be glad to eat with us if it wasn't for keeping up appearances.

Besides, does Mr. Name Withheld think the bosses are the only ones who want to talk things over without being overheard? We have things to say, too, that we don't particularly want them to know about. There's such a thing as carrying democracy too far. I see enough of my boss the rest of the day, without having to eat lunch with him, too.

Of course, there are always some guys who like to hang around with the boss, but I think if you took a poll you would find that the majority of the men don't give a hoot whether there is a private dining room or not.

T. Langer
Cincinnati

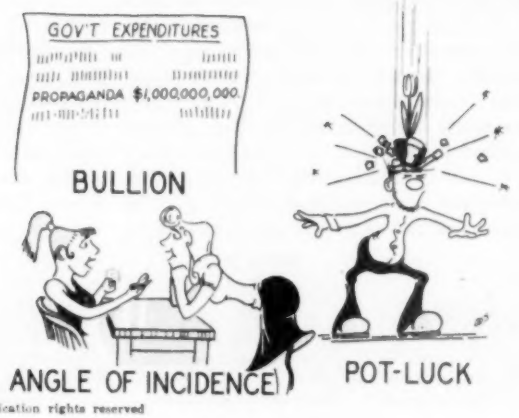
Time Waster

In these days of high production and high efficiency, one small but highly important factor is overlooked in many shops, and results in an almost unbelievable loss of time. I refer to the illegibility of many of the blueprints to which a machinist is supposed to work.

When I was an apprentice, back in the "old country," we made our prints with the aid of old Sol, and an occasional bad print was excus-

GRINETICS

BY D. G. SMITH



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Tandem bearings made

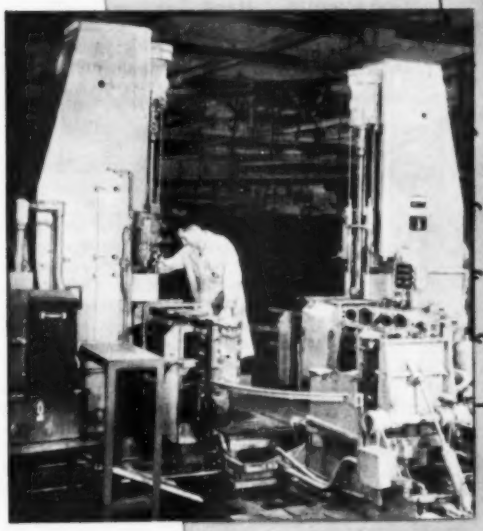
ROUND ★ STRAIGHT ★ IN LINE

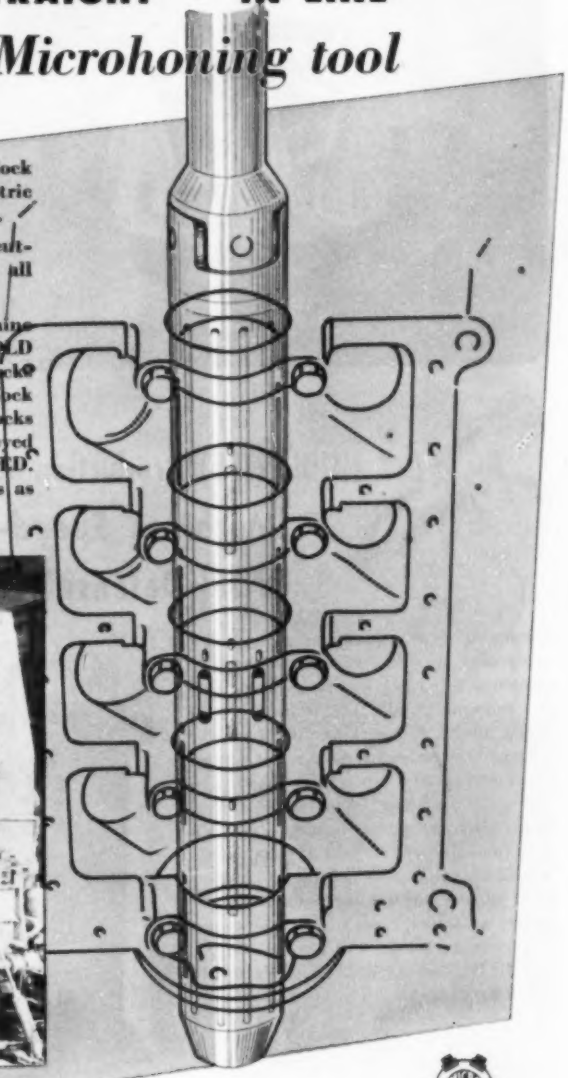
with NEW Microhoning tool

ALL FIVE bearings in V-8 cylinder block MICROHONED within .0005" for diametric size, roundness, straightness and alignment.

Plastic guides stabilize tool and control cutting. One bank of abrasives MICROHONE all bores.

This double column Model 740 machine equipped with new guided type MICROMOLD tools MICROHONES Main Bearings in 60 blocks per hour, removing approximately .002" stock from the diameter of each bearing. The blocks are automatically taken from the line, conveyed to either of the columns, and MICROHONED. The operator makes occasional spot checks as the blocks leave the machine.





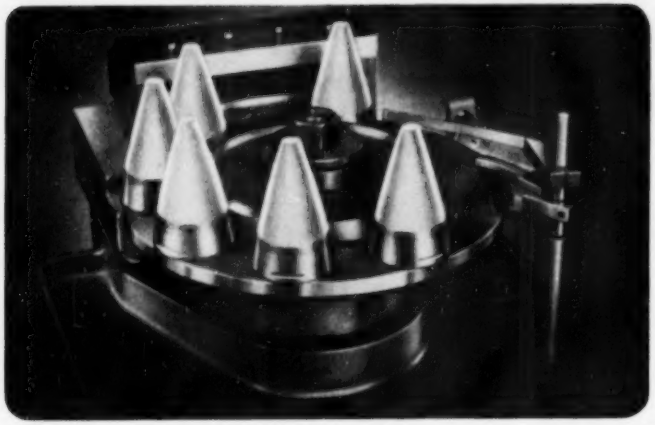
Write for Cross Hatcher for complete story on MICROHONING Interrupted Surfaces

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 4, MICHIGAN

District Field Offices: 1323 S. Santa Fe Avenue, Los Angeles 21, California • 206 S. Main Street, Rockford, Illinois • 231 S. Pendleton Avenue, Pendleton, Indiana • MICRO-MOLD Manufacturing Division, Boston Post Road, Guilford, Connecticut • 55 George Street, Brantford, Ontario, Canada

LEADERS IN INDUSTRY MARK WITH NOBLEWEST



Model 328 tooled for marking conical surfaces of Fuse Insert Parts

Again NOBLEWEST Production Marking Machines *Speed-Mark* Vital Defense Products

Noblewest rapid production marking equipment is again meeting industry's challenge for better and faster marking. For example, Model 329 (illustrated at right), tooled for marking 20MM shells is capable of marking 4000 to 6000 per hour, depending upon the handling facilities. Leading manufacturers in many fields are saving time and money with these superior marking machines. Whatever you make—in metal, plastic, hard rubber—you too can mark it faster, better, at lower cost with Noblewest. Just write to Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

A MARK IS ONLY AS GOOD AS THE DIE THAT MADE IT. Noblewest marking dies for the machines described above are made by master craftsmen to exacting standards that result in clearer impressions and longer life . . . the ideal dies and die holders for production marking equipment.

MARK IT BEST WITH

NOBLEWEST Roll-O-Matic MARKING

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

able. But with the automatic, controlled lighting, high-speed machines now available, there is no excuse for anything less than a perfect print every time.

With the weak-kneed, washed-out, hazy blueprints we so often get (and red-line prints are even worse), either we make mistakes or we waste precious hours trying to decipher the draftsman's work.

I know draftsmen are highly paid, but the final cost would be much lower if they would take a bit more care in writing their figures, and in making sure that they do not have conflicting dimensions or tolerances on different views of the same part.

One more gripe. When a complicated assembly is involved, it would save a lot of time and trouble if the draftsman would include a few small subassembly sketches. He should know how parts are to go together, but the man at the bench is no mind reader and often loses a lot of time trying to puzzle out something a sketch would reveal in a minute.

A. T. Renson
Atlanta, Ga.

More Fundamentals

Would it be possible to have more fundamental articles, similar to the recent one on reamers?

Robert R. Calhoun, Jr.
Philadelphia

Reader Calhoun is probably referring to "Emergency Reamer Practice" (AM, Jan 7).

***Although** we have no trouble in obtaining good articles on shop operations, articles on fundamentals are not so easy to obtain. That is why many of our Special Reports are written by our editors from information gathered from many sources.*

The article in question was contributed by a reader who often sends us Practical Ideas, and we suspect it covers the type of information in which he, himself, is most interested. Those who are most interested in basic information are, themselves, often the best sources of that information. Perhaps Mr. Calhoun has some basic information that might be of interest to other readers.—Ed.

Truth Will Out

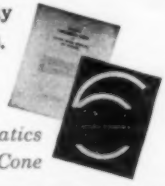
I noted in a recent issue (*AM*, Feb. 4) that "Al of Waterbury" wondered how real authors of Round Table comments might be. My own replies are definitely written from practical, first-hand knowledge, and are frequently my own solutions to the defi-

Front Side of Tooling Area
Rear Side of Tooling Area →

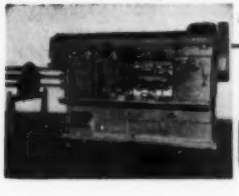
If you have a tough forming job in mind for a new "automatic," it's more satisfactory to know the recommended maximum load of the proposed machine's cross slides than to merely be told that they are *rugged.*

Before a machine can satisfy an important requirement it must be *built that way.* And built to figures instead of adjectives.

There are many factors involved in the building of any brand of Multiple Spindle Bar Automatic, factors on which you may want the figures. You may have the figures on CONOMATICS.



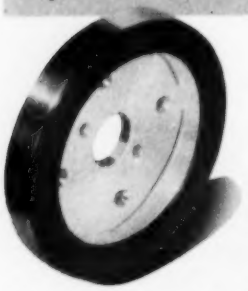
A Comparison of ALL Automatics is in Favor of Cone



In producing the alloy steel part shown, the maximum load recommendation for each main cross slide of the 3½-SIX is 8,000 foot pounds. The total net weight of the main cross slides is 825 pounds.

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

Grind More Carbide per Carat of Diamonds



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nite and identical problems outlined in the original article.

I have worked in several different states, and have found shop help, shop problems, and management difficulties to be pretty much the same everywhere.

Charles D. Townsend
Industrial Engineer
West Hartford

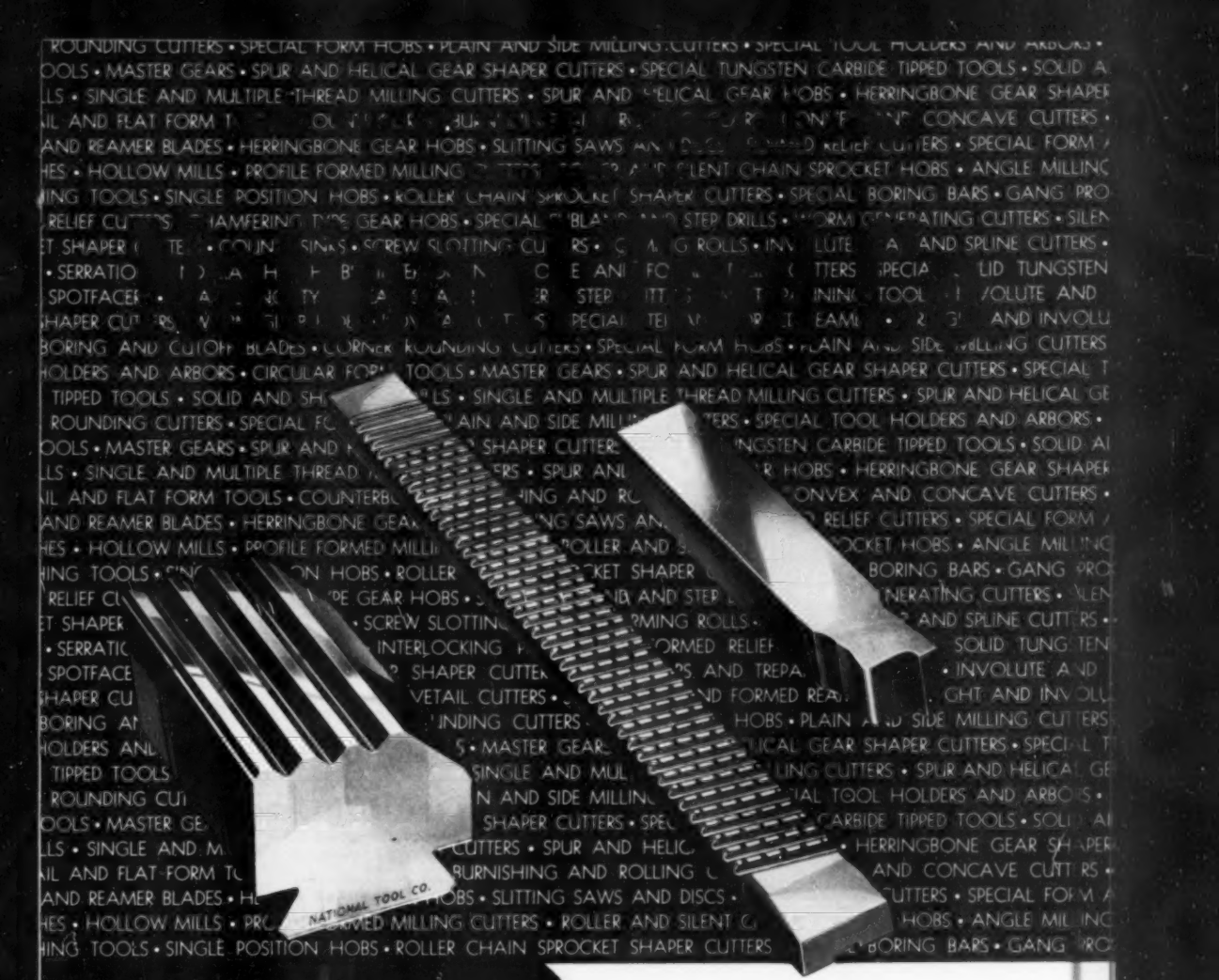
Fond Recollection

The article on the use of soft hammers, by John E. Hyler, (*AM*, Feb. 4) was not only very informative with suggestions that can be followed to advantage in many shops, but it struck me in a tender spot as well. Too few seem to use these hammers to the best advantage.

I was especially interested because one hammer you illustrate was patented by me, about 1887, while I was working as a toolmaker in a little shop in Philadelphia. All our soft hammers had malleable-iron heads with recesses in each end for the rawhide or lead faces. When these faces wore out, we had to take out the handle, chuck the head in a lathe and bore out the material.

Some melted the lead out and reused that metal as the soft face, but we preferred to bore it out, as we did the rawhide inserts. So one day I sketched the hammer head shown and dug up money to get it patented. This was not especially easy at the wage prevailing at the time, $2.50 a day for a toolmaker or good machinist. After considerable correspondence, Henry Blake & Son, Pepperell, Mass., decided to undertake the manufacture. I do not recall whether they attempted to market it or not but it soon found its way into the hands of Greene, Tweed & Co., New York. I recall that my royalties were just about enough to pay for the patent. I recently bought a small hammer for my grandson just to show him what the old man had done years before he was born. It is some satisfaction to see them in use even if I do not get a royalty.

Fred H. Colvin
New York



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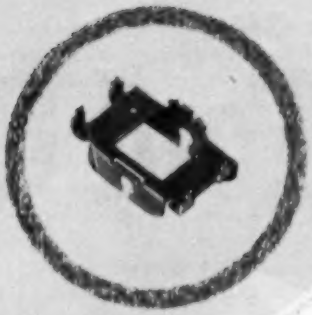

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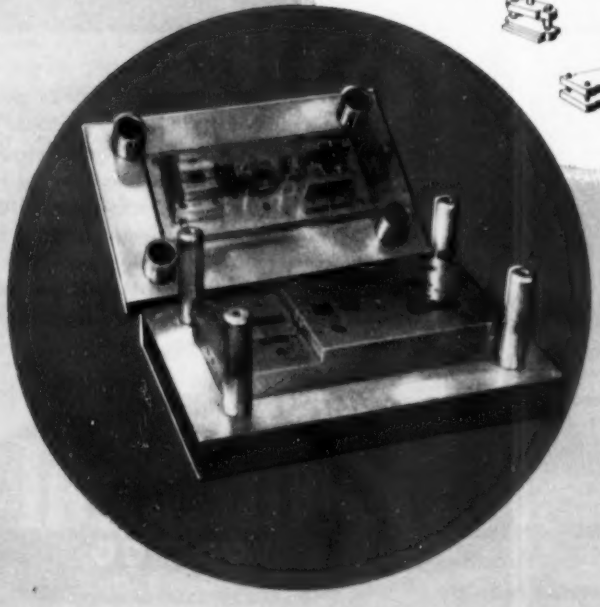

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SPOT NEWS of Metalworking

- **Defense department procurement officers are way behind on letting contracts.** They'll have to speed up to at least $6 billion per month for the rest of the fiscal year. That's almost double the present rate. But even then, chances are that Pentagon may have to turn back as much as $7 billion in procurement funds first of July.

- **Production will start next month on F-86F Sabre** that's supposed to outperform the MiG-15. It has the new GE J-47 turbojet with afterburner. Heavy output isn't expected immediately, however, because the J-47 still has a production problem—shortage of machine tools and scarce thermal alloy steels—that won't be licked until mid-summer.

- **Productivity wage increases—by another name—have been approved** by the Wage Stabilization Board in the electrical industry. It permitted increases of 2½%, or four cents an hour, negotiated last fall, to go into effect for 340,000 employees of General Electric, Westinghouse, and Sylvania. The increase brings to 67 cents an hour the amount of increase in hourly rates of GE employees since the war.

- **Process for nickel coating of aluminum has been developed** by Hamilton Standard Div. of United Aircraft and Bart Laboratories Co., Inc., Belleville, N.J. In the process, called "Alni-Clad," a synthetic rubber compound is sprayed onto aluminum to the required thickness. After drying, the piece is plated with nickel by conventional means. Finished pieces have hardness of 400-450 Vickers and are stress-free. Used by Navy to protect duralumin props.

An electronic wristwatch, announced by Elgin National Watch Co., replaces the mainspring and winding mechanism with an energy capsule or battery and a motor containing a 3000-turn coil. Each is ⅛-in. in dia, the battery a little over ¼-in. long, yet capable of powering the watch for a year.

- **German machine-tool builders, to get orders in U.S. and other foreign markets,** are being given special inducements by German government. By registering U.S. sale with government agency, builder receives priority on iron and steel deliveries equal to 10% of value of exported machine. Only 5% credit is extended on orders to other countries, such as Brazil.

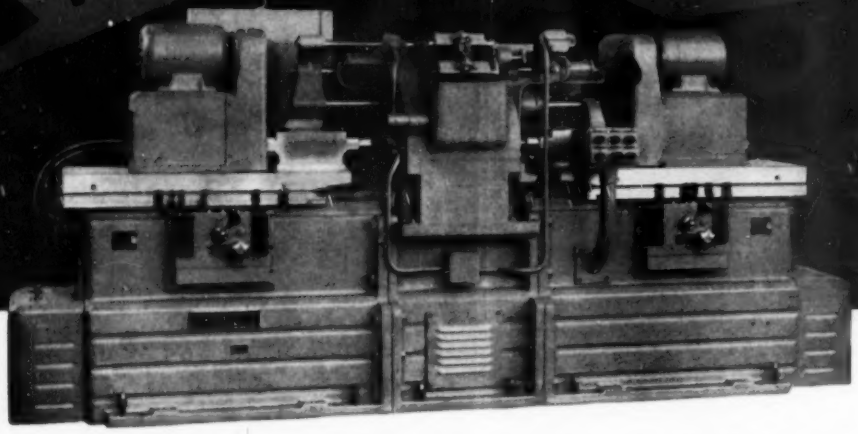
- **Teams of machine-tool experts, from machine-tool industry, are being organized** to go to defense contractors and find out exactly what situation is—what they have done with machines already delivered, what kind of future deliveries they must get to produce up to quotas, whether some machines may not be needed at all or not as soon as requested, and how efficiently the machines are being used. Similar plan was carried out in World War II.

- **A $200,000 contract to develop use of titanium alloy in manufacture of jet pod parts** has gone to Consolidated Vultee Aircraft Corp. It's one of first awards to an aircraft manufacturer for titanium alloy development, previous ones having been for development of pure titanium uses.

- **Boeing will get $1,250,000 Air Force contract** for development of giant "three-dimensional duplicating contour milling machine," the first to be designed specifically for machining the large forgings which will come from presses such as the 50,000-ton machine at Wyman-Gordon. Kearney & Trecker is expected to build the miller to Boeing specifications. Present plans call for a series of beds, tracked on both sides and able to be joined endwise, 16-ft long, with 5-ft wide table and 13-in. clearance over the table. Machine will be powered by a 35-hp motor and provide feeds over 600 ipm.

- **Radioactive ethyl chloride, added to cutting fluid,** is being used at MIT to study flow at the interface (between chip and tool). A thimblefull of the material costs $250 and half-life is relatively short, so tests must be run carefully but quickly. This study may show what actually happens when fluid meets tool and chip.

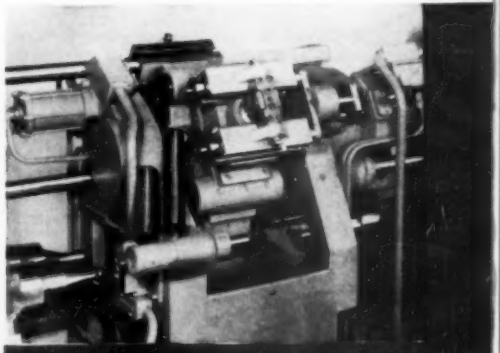
DOUBLE ACTION FOR DOUBLE PRODUCTION



EX-CELL-O TWO-WAY MACHINE BORES, CHAMFERS, AND FACES BOTH ENDS OF TUBULAR STEEL PARTS AT NET RATE OF 366 PIECES PER HOUR!

Ex-Cell-O Way Type Precision Boring Machines save time by machining parts from two or more directions at the same time. And relationship of the various operations to one another is exact because the accuracy is built into the machine—it does not depend on the accuracy of repeated locating and clamping.

The machine illustrated here has a trunnion type indexing fixture, machines both ends of two parts per cycle, ejects the finished work automatically. Have your Ex-Cell-O representative explain all the advantages of these machines to you, or write today to Ex-Cell-O in Detroit for further information.



EX-CELL-O CORPORATION DETROIT 32 MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS - CUTTING TOOLS - RAILROAD PINS AND BUSHINGS
DRILL JIG BUSHINGS - AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS - DAIRY EQUIPMENT

Washington

Decontrol talk is official now. Defense Production administrator Fleischmann thinks we can start shedding CMP next January. And Congress and Office of Price Administration are racing to see who will start decontrolling prices.

• • •

We'll get enough carbon steel this year to drop allotment of most shapes and forms, Fleischmann feels. Allotment of aluminum should stop in January—or April, at latest.

Allotment of copper will continue — for at least another year. There'll be a little more for civilian uses as military needs decline but not nearly enough for everyone. And scarce steel forms—plate, rods, tubing—and alloys like nickel, cobalt, tungsten, etc., will be kept under allotments.

• • •

What comes after CMP is the problem DPA top staffers are working on now. Military demand will stay high until 1954—high enough to require some sort of controls to assure a flow of metals into weapons.

A priority system solely for military production is what the controllers want. But they're in a quandary over what to do about common components—valves, bearings, electric motors and the like — vital to both military and nondefense production. That's proving tough to handle even with CMP.

• • •

DPA-NPA will stay in business even after they free steel and aluminum. Agencies will have to help military on production problems, like components shortages, as well as ladle out copper, alloying materials.

And materials controls will come back fast in event of major war. A prolonged steel strike would stop all talk of easing up on any metals restrictions indefinitely.

• • •

OPS plans spot decontrol of prices. It would lift controls on items that: (1) now are well under ceiling prices; (2) are not in for a price rise in the foreseeable future; (3) can be watched easily, price-wise, by OPS.

Few hard goods would qualify under these and other OPS standards for decontrol. Most durables are selling near ceilings or are subject to quick price fluctuations.

• • •

It adds up to only suspension of controls. OPS wants to stay in position to crack down again if prices soar.

But Congress is talking decontrol in broader terms. It wants a set formula for dropping price controls—which OPS says is impractical. Showdown probably will come soon.

Decontrol is tied to lagging arms output, of course. The military brass like to blame the stretchout—the President's decision to hold down peak weapons production, extend deliveries over another year (1955).

But arms deliveries are far behind schedule—even the latest schedules prepared by the military extend rearmament into 1955.

• • •

Big lags are in aircraft, tanks, most modern weapons. The services can get more trucks, small arms, uniforms and food than they need. That's what keeps military spending high.

Take tanks. Output of medium tanks got so bad last December the Army just tore up its delivery schedules. Problem is design: tank's new, fancy turret simply doesn't operate.

• • •

Story on aircraft is even sadder. In one recent month we got less than 50 of our best fighters. B-47 jet bombers still aren't in anything near large-scale production. That's the hot medium bomber Air Force expected to be rolling last fall. New, advanced models of all types are still largely on drawing boards.

• • •

Air Force blames shortages of tools first, components second for delay. But industry people say big problems are air generals' constant changes in specifications, failure to spot tool and parts shortages quickly, lack of coordination in ordering.

• • •

Armed forces want new draft law, now Congress has killed Universal Military Training. Proposed draft revision would put draftees in active service for three years, in reserves for another three.

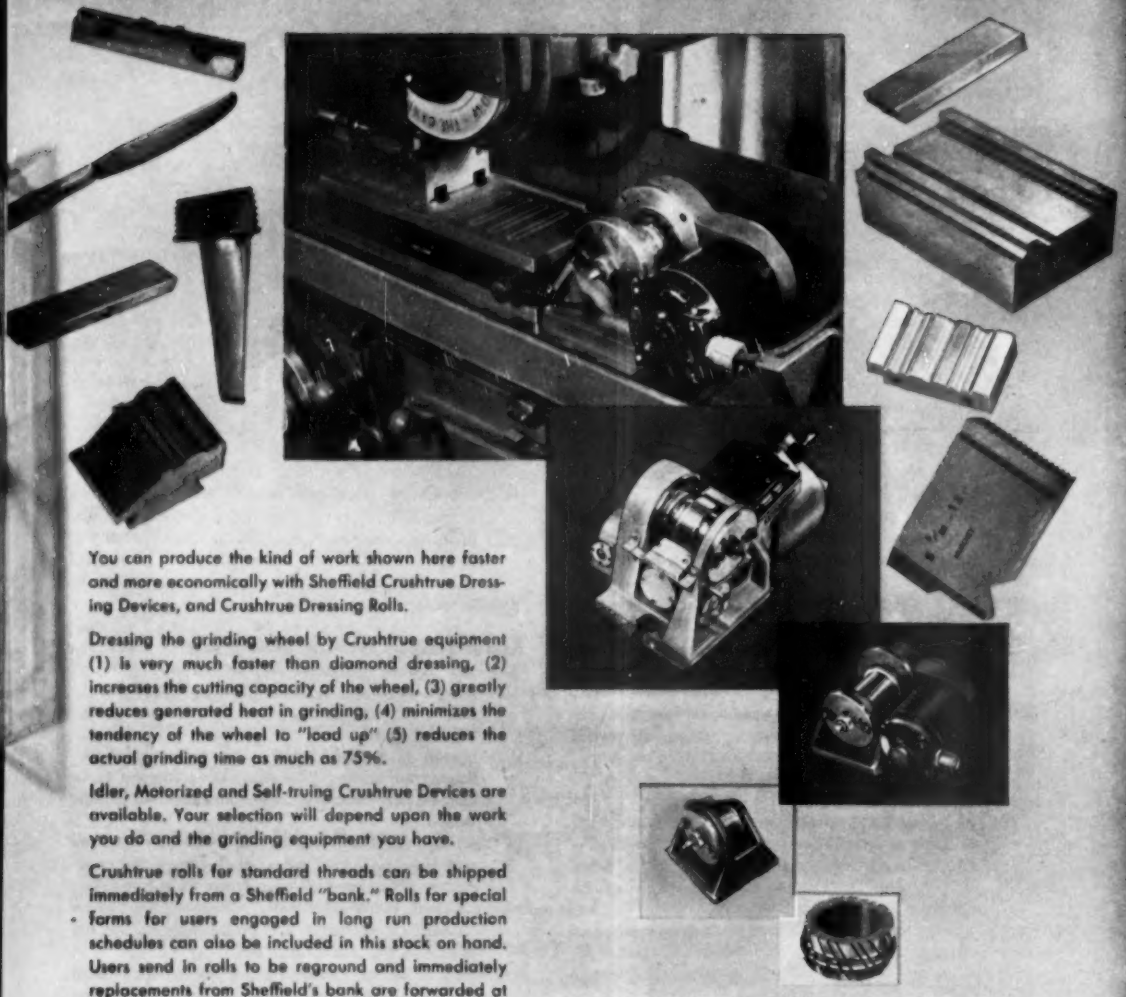
Washington is getting tougher on Communist influence in unions. The squeeze is coming from Capitol Hill and the National Labor Relations Board.

In Congress, the Un-American Activities Committee and the McCarran Internal Security Subcommittee got encouragement from what happened at Ford. UAW-CIO leaders followed up House committee exposure of Communists by taking over the big Ford local 600.

Secretary of Labor Tobin urged a senate committee to take bargaining rights away from Communist-dominated unions, put them in the same position as company-dominated unions.

At NLRB, bargaining rights were taken away from the left-wing United Electrical Workers' local at Sunbeam Corp. Reason: The UE local had not included three trustees and a sergeant-at-arms among officers who had to sign non-Communist affidavits.

Equip for Crushtrue Grinding to Speed Production and Cut Costs



You can produce the kind of work shown here faster and more economically with Sheffield Crushtrue Dressing Devices, and Crushtrue Dressing Rolls.

Dressing the grinding wheel by Crushtrue equipment (1) is very much faster than diamond dressing, (2) increases the cutting capacity of the wheel, (3) greatly reduces generated heat in grinding, (4) minimizes the tendency of the wheel to "load up" (5) reduces the actual grinding time as much as 75%.

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Write for information on the Sheffield "Crushtrue Roll Bank" and specifications on these Crushtrue Devices.

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Detroit

On the surface, the row between CIO United Auto Workers President Walter Reuther and Carl Stellato, president of the huge Ford Rouge Local 600, seems strictly a battle inside labor.

But Ford Motor Company, uncomfortably situated right in the middle, conceivably could feel the main squeeze.

• • •

Not unexpectedly, UAW's International Executive Board installed a board of administrators over the local, after being roused into action by finding of the House Un-American Activities Committee. Delving into the problem of Communist influence in Detroit auto and steel plants, the committee found that upward of 175 CP members held tight control of union policy at the Rouge.

In the wake of the hearings, the UAW held its own hearing, was not convinced by the local officers' testimony that all possible action to rid the local of Red influence had been taken, and set up the administratorship.

The action was the end result of a year-long feud between Stellato and Reuther, who parted enemies after UAW's last convention. Reuther's latest effort was not directed so much against the Reds—it has long been known that Commies cracked the whip at the Rouge—as it was against Stellato, from whom Reuther wants to wrest control of the world's largest union.

• • •

An election comes up within two months. Stellato and three other top officers will run, with powerful backing from the Commies and other anti-Reuther factions. Their chances of victory are better than good. Reuther's rightwing has no strong candidate.

Reuther is certain to uncork a hot campaign, however, which—in the environs of the always rebellious, violently independent Ford local—could produce sporadic walkouts, even a full-dress strike. The fight has Ford officials on the edge of their chairs, as well it might. If the company—in its innocent bystander role—emerges unscathed, more than a few people will be surprised.

• • •

Behind-the-scenes aspect of the General Motors power-steering unit: The installation was perfected almost ten years ago. But nobody in GM thought customers would pay $200 for it.

When Chrysler pioneered the device a year ago, proved the analysts wrong, GM lost no time in following the competitive lead.

At present, the GM Saginaw Steering Gear Div., is building about 250 units per day. It plans to be up around 1000 by August. Materials are no problem—no critical items are used.

This year's Mobilgas Economy Run, coming up in mid-April, will follow a thousand-mile course between Los Angeles and Sun Valley, Idaho. The exact course will not be announced until just before the run gets underway. Reason: Officials want to keep drivers from making early test runs.

In other years, some drivers have traveled the course ahead of times, memorized it, checked road conditions, spotted and timed traffic signals, and so on, thus putting them in a more favorable position than the contestants who went into the run "cold," as well as distorting the final performance statistics.

• • •

How complex can production become? Currently rolling out from under the same roof at Kaiser-Frazer's Willow Run plant are three auto models and large military aircraft model. Kaiser's 1952 Manhattan and deluxe models as well as the new Henry J, are coming off assembly lines daily, while C-119 Flying Boxcars move down another line near by.

Next fall, K-F expects to begin wheeling another aircraft model—the C-123—out of the plant while production of the aforementioned cars and plane continues.

• • •

One problem creates another. Manufacturer of automatic transmissions got cut back by government allocation. Now at least one company (and likely more) are finding some resistance, particularly in the urban centers, against cars that do not carry the automatic transmissions.

It looks as though the manually-operated transmission is going the way of old Dobbin.

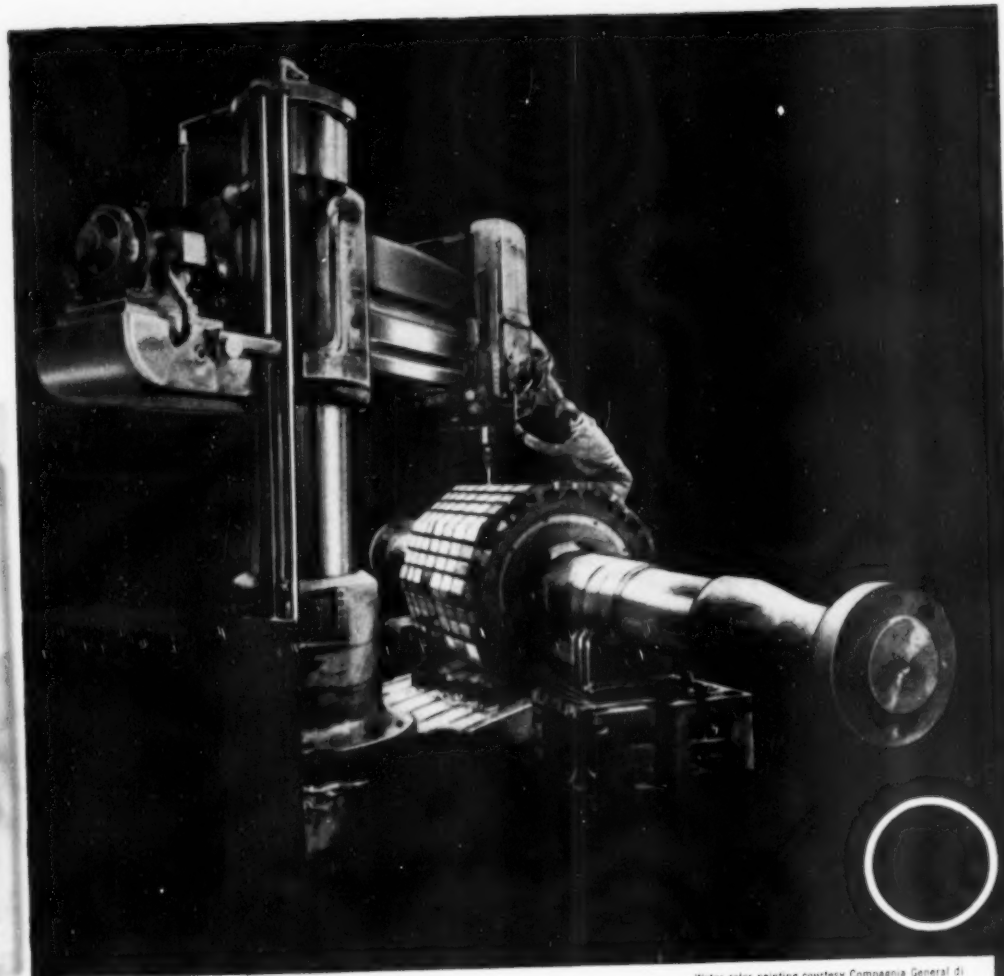
• • •

Budd Company is telescoping somewhat the tooling process for new automotive sections. As soon as the lines appear in preliminary designs, soft-wood models are made. This makes it possible to study requirements for changes to fit manufacturing—a detail often by-passed until the hard mahogany forms are shaped. Some notable time savings have resulted, according to recent reports.

• • •

Die engineers at Fisher Body are getting more to say about shapes and specifications of steel—the idea, of course, is to save on that hard-to-get commodity. Die engineers recommendations have resulted in some gage changes, in reduced costs on press equipment, and quicker loading and unloading of parts in process.

One notable study: Intense examination of parts, coupled with occasional gage modification, resulting in the nesting of blanks and reduction of scrap.



Water color painting courtesy Compagnia General di Electricita, Milano, Italy.

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Machine Tools

A plan which involves large purchases of machine tools is being worked out in Washington for broadening the base of the nation's armament production facilities.

It is part of a master plan for continuing the defense program on a practical basis into the indefinite future. It will help build up a permanent manufacturing establishment for war materiel.

• • •

The new program, which supplants the so-called stockpiling idea, calls for creation of new productive capacity for individual defense items on a larger scale. It includes adoption of government policies which will be designed to keep the machine-tool industry strong.

First step in putting the plan into action will be appointment of a commission by defense mobilizer Charles E. Wilson. Harold Vance, head of Studebaker, has been asked to be chairman. Then there will be four other members, one each from the three armed services and one from the machine-tool industry who also will represent the Munitions Board.

• • •

The plan itself is expected to work out about like this: Suppose we take a jet-engine project as an illustration. Air Force wants production as soon as possible of 200 engines a month. But it wants to secure from this one plant 1000 engines a month in case of all-out war.

The plant would be tooled up immediately, under the proposed plan, for 200 engines a month on a single shift five days a week. Then further reserve machines would be bought (30-40% of original number) for this line.

Full production of 1000 engines a month would be obtained by operating the original line and the extra "bottleneck" machines six days a week round the clock.

• • •

This plan would be followed for a number of basic types of defense products — tanks, engines, planes, guns. Flexibility would be one of main objectives in purchasing reserve machines for enlargement of production to maximum. This would be in anticipation of possible product design changes.

Machine-tool tight spots in World War II will be studied to find out what types of long lead-time critical machines should be available in advance of another emergency. Then orders will be given out to builders for production of such machines to put into a national reserve.

These machines will be built in conservative numbers. No attempt will be made to go hog-wild.

Many machine-tool orders for this proposed scheme probably would be placed this year. It is likely to be 2-3 months or longer before any of them reach builders, however.

Washington predicts a buying wave later in year as direct result of implementing this plan.

• • •

This is a sketchy outline of the plan which has the backing of top brass at Pentagon and of Mr. Wilson. Clay Bedford is in the thick of it. NPA officials are enthusiastic about it.

All the details have not been spelled out. That is one of new commission's important tasks.

• • •

One point is clear. There is to be no stockpiling of machine tools as such. Tools would be ordered for a specific project and not bought helter-skelter on a guessing basis.

Clay Bedford regrets that the word "stockpiling" ever was used to describe the plan which he proposed. It suggests the piling up of machines in warehouses.

• • •

The commission will study, among other things, ways and means whereby the machine-tool industry can be maintained on a strong basis.

All phases of machine-tool builders' problems will be examined, such as renegotiation, other fiscal matters, pros and cons of a more liberal depreciation policy by the government.

Commission is being given that name because its function is regarded as far more important than a mere committee.

• • •

Pentagon says that the services have the money to buy most, if not all, the machine tools essential to long-term mobilization.

Getting the military to say definitely what projects should be tooled up for possible full mobilization is one of the troublesome problems in carrying out the proposed plan.

• • •

Easing of the rule whereby no unrated orders for machine tools can be shipped by builders is now being studied. Some companies have very little defense business. Their machines are not of the type in demand for current armament work. They will be allowed to fill unrated orders when the rules are relaxed.

Some relief in connection with unrated foreign orders also is in the making.

• • •

An up-to-date version of World War II's E-1-B soon will be announced in Washington. It will govern the scheduling of machine-tool deliveries to defense projects according to a master preference list.

Individual builders then will take over the scheduling themselves. List may contain over 200 items of specific defense contracts.

How to CUT precision

AIRCRAFT GEARS CUT IN 33 SECONDS EACH

These 5-11/16" P.D. aircraft gears checked to way under .001 in. for max. involute error and parallelism, and about .001 in. for maximum runout and spacing error, as they came off the Shear-Speed.

AIRCRAFT GEARS Faster!

Sure, you can produce precision aircraft gears by slow methods . . . but, WHY do it that way when there is a quick way to do the same thing?

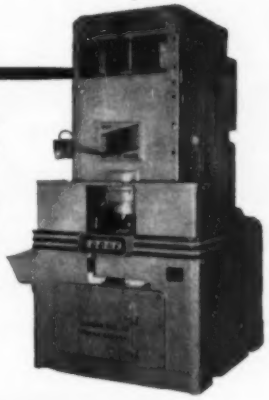
The fastest proven methods to cut precision gears, as used in aircraft, are:

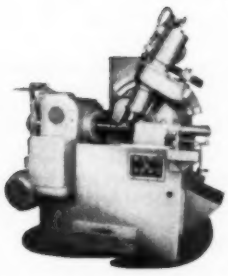
SPUR GEARS

Step 1: Cut all teeth simultaneously on a Michigan Shear-Speed gear shaper. (For time and tolerances, see example at left.)

Step 2: Finish the gears by Michigan "Underpass" (★) shaving, the fastest of all gear finishing methods.

Note: If "ground gears" are specified, Underpass shaving will cut your grinding time in half at negligible cost for the shaving operation.





HELICAL GEARS

Step 1: Hob the teeth on a Michigan #1458 high-speed hobber—the fastest single spindle hobber in the world . . . *faster than most multiple-spindle machines.*

Step 2: Finish as for Spur Gears.

★ *On aircraft pump gears, it may be desirable to use 'Modified Underpass' or 'transverse' shaving, depending on length of run, face width, etc.*

MICHIGAN TOOL Company

7171 E. McNICHOLS RD. • DETROIT 12, MICHIGAN, U. S. A.

3 Typical Examples of GREATER OUTPUT ...REDUCED COSTS

. . . with Texaco Cutting Fluids and Lubrication Engineering Service

*EXAMPLE No. 1: *130% Greater Production between tool grinds.* Steel pump parts were being machined on automatics. When *Texaco Cleartex Cutting Oil* replaced a competitive fluid, production between tool grinds more than doubled. Moreover, *Texaco Cleartex Cutting Oil* could be used as both coolant and machine lubricant, eliminating contamination and oil wastage.

*EXAMPLE No. 2: *75% Longer Drill Life.* The job was drilling shotgun barrels. Short tool life was overcome by the Texaco Lubrication Engineer's knowledge of the right *type* of cutting fluid to use. When *Texaco Sultex Cutting Oil* went on the job, tool life nearly doubled and downtime for tool changes was greatly reduced.

*EXAMPLE No. 3: *Chaser Life Doubled.* In threading stainless steel packing nuts the greatest difficulty was frequent chaser breakage. Change to *Texaco Cleartex Cutting Oil* increased chaser life from three to six shifts. In addition, both steel and brass can now be worked without changing oil. *Texaco Cleartex Cutting Oil* does not stain.

Whatever the metal being worked or your method of machining it, there is a *Texaco Cutting, Grinding or Soluble Oil* to enable you to do the job better, faster, at lower cost. A Texaco Lubricating Engineer will gladly work with you.

To keep your hydraulic mechanisms free from sludge, rust and foam, use *Texaco Regal Oil (R&O)* — turbine-quality oil that gives extra protection, reduces maintenance costs.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

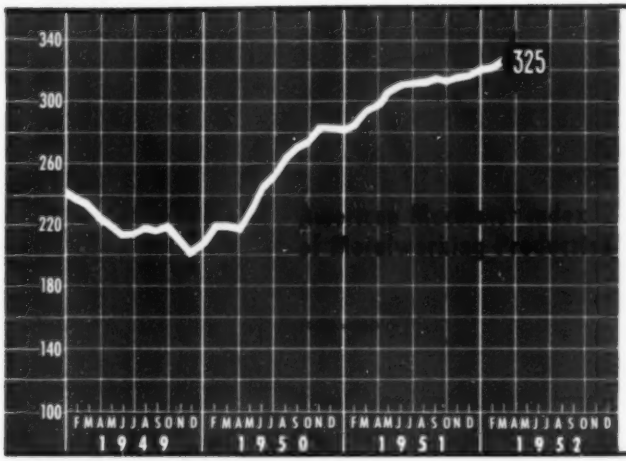
The Texas Company, 135 East 42nd Street, New York 17, N. Y. *Name on request

TEXACO CUTTING, GRINDING AND SOLUBLE OILS FOR FASTER MACHINING

Faithfully yours 50 *for Fifty Years*

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

Gaging Metalworking



INDEX

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	MAR '52	FEB '52(p)	JAN '51(r)	FEB '51
	325*	**323**	**320**	**297**
Machinery	325	322	293	
Electrical Manufacturing	368	364	333	
Automobiles, Trucks	219	218	251	
Transportation Equipment	500	493	337	
Other Metalworking	317	314	299	

* Estimated (p) Preliminary (r) Revised

Metalworking production is believed to have risen slightly the past month. AMERICAN MACHINIST's Index is estimated at 325 in March, up two points from February and five points from January.

Operations, on the whole, are just about holding their own. Aircraft industry has provided the big gain, of course. And it will continue to expand through 1952.

First-quarter orders have been disappointing to many companies. That is true in heavy as well as consumer goods.

• • •

Feeling is, however, that Metalworking perhaps is at the bottom for the year.

But prominent companies in both fields have not lowered their sights for the year as a whole.

Some look to the last half of the year to provide the pick-up which thus far has not come.

After midyear defense output should show a marked gain, especially in the fourth quarter. And capital-goods producers should be at a new postwar peak.

• • •

Consumer goods industries are more uncertain about what is going to happen than any other segment in metalworking.

When they get bigger CMP quotas, the question is whether they will be able to use them. Retail markets for appliances and automobiles are relatively weak just now.

Some observers feel that seasonal influences have made managements too pessimistic about the immediate outlook. Come spring and consumer buying will rise substantially.

The situation has almost turned around completely in steel. Whereas buyers went to mills with hat in hand until recently, now steel salesmen are out looking for business. And in certain lines they are having trouble finding it.

Customers suddenly have come up with inventories which heretofore they didn't seem to possess.

Steel people see no reason why practically all steel products should not be decontrolled by third quarter or fourth quarter at latest.

All bets are off, of course, if a steel strike occurs.

• • •

Even copper is a bit better. It used to be that users got CMP tickets which they couldn't cash at the mills. Now they are cashing all of them.

The big debate over copper — whether the nation faces a severe shortage indefinitely—has been settled. Supply and demand should be in balance by 1955, DPA says.

Copper producers had been saying exactly that, in vain, for months.

Current easing is not expected to last. Copper is likely to get shorter later in the year.

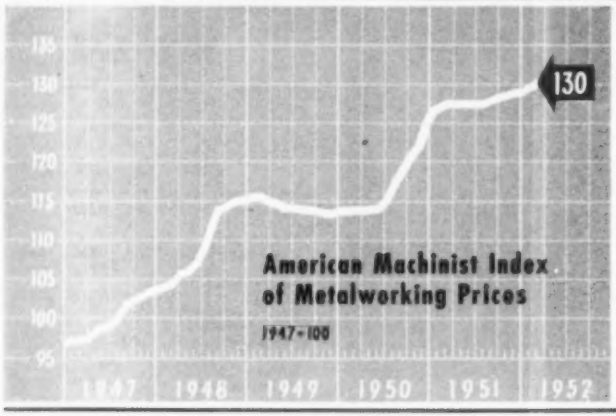
• • •

Around 70% of aluminum output is going to direct defense and remainder to essential civilian and defense-supporting industries.

CMP allotments are taking complete output of the aluminum industry just now.

Another round of production expansion in aluminum has been vetoed. Purchase of aluminum from Canada has been postponed. Feeling is that current softening of demand may result in plenty of aluminum being on hand.

Gaging Business



PRICE INDEX

	FEB '52	JAN '52	FEB '51
	130.0	**129.2**	**127.1**
Metalworking Machinery	136.2	136.2	133.8
Other Machinery except Elect.	132.9	132.8	132.1
Electrical Machinery	126.6	126.5	126.8
Fabricated Metal Products	128.2	126.7	123.4

AMERICAN MACHINIST Index of Metalworking Prices is being shown for first time in the above chart. Detailed explanation of this index and its components is on page 132.

Business will hold at a high level for the balance of 1952. But it won't be smooth sailing for all industries.

Last year was extremely stable. Industrial output held to a fairly even keel. But while the general average was stable, individual sectors varied considerably. Machine-tool shipments gained about 100%. Defense spending rose nearly 100%. Auto output was down 12%. Electrical appliances production was off about one third. Radio and TV output was down about 40%.

In 1952 the annual rate of defense spending will rise about $15 billion. The "stretch out" has cut about $5 billion from the original defense spending plans. About $58 billion will be the annual rate at end of 1952.

• • •

Few people are worrying about inflation in the U.S. these days. Most consumer goods will continue in ample and increasing supply. Prices of some of these goods may come down.

Manufacturers' sales and new orders increased in January. Increasing deliveries of defense items upped shipments of durable goods more than 10% over last January. New orders showed substantial gains in January. Durable goods industries accounted for 75% of this rise.

• • •

Inventories and backlogs of manufacturers showed little change between December and January. Manufacturers' inventories, after seasonal adjustment, actually declined for the first time since July, 1950.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1923-1925 = 100)*	238.5	237.5	234.5
Steel ingot operation (thousands of tons)	2,127	2,114	2,021
Electric power output (million kilowatt hours)	7,414	7,497	6,903
Production of automobiles and trucks	118,777	115,126	182,781
Engineering construction awards (*Engineering News-Record*, millions)	$250.8	$223.8	$159.8

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1935-1939 = 100)*	219	219	221
Index of durable manufactures production (1935-1939 = 100)*	281	280	271
Durable goods manufacturers' sales, millions*	$10,084	$10,753	$9,869
Electrical machinery manufacturers' sales, millions*	$1,061	$1,090	$1,035
Other machinery manufacturers' sales, millions*	$1,865	$2,095	$1,552
Durable goods manufacturers' new orders, millions	$10,322	$11,090	$11,703
Electrical machinery manufacturers' new orders, millions	$1,476	$1,212	$1,463
General machinery manufacturers' new orders, millions	$1,841	$1,981	$2,234

* Seasonally adjusted.

New *Flexible Sealing...*

T-J AIR CYLINDER

Designed with revolutionary application of

Super-Cushion

It's *sealed with pressure*—a revolutionary T-J application of flexible sealing that insures positive cushion action combined with automatic valving action for fast return stroke . . . eliminates binding and sticking . . . operates with *low friction, minimum wear,* and *added power* due to higher efficiency.

More PLUS features! New type packing nut incorporates a piloted diameter, assuring perfect alignment. Improved rod packing increases sealing efficiency. Piston rod and internal cylinder tube surfaces are hard chrome plated—a standard practice with T-J for over 15 years. Basic design is safety-stressed for air line pressures up to 100# PSI. Write for bulletin 252 . . . The Tomkins-Johnson Co., Jackson, Mich.

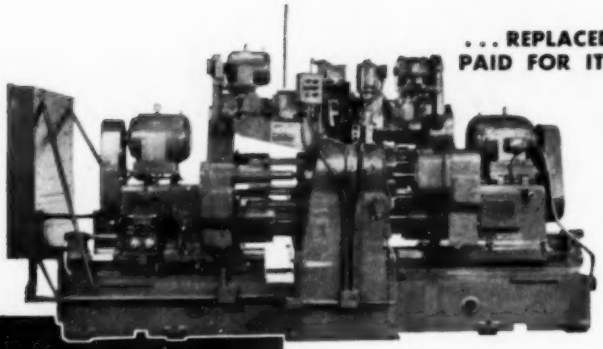
1. Metallic rod scraper to protect rod bearing and packing from dirt and grit.
2. Wrench flats.
3. Self-adjusting chevron type packing.
4. Permanent type adaptor ring.
5. Hi-tensile tie rods.
6. Heavy duty, hard chrome plated rod.
7. Generous fillet reduces stress concentration.
8. "O" ring static seal.
9. T-J new flexible cushion seal insures positive cushion with automatic valve action for fast return stroke. (Patent applied for)
10. Fine cushion adjustment.
11. Heavy wall precision honed hard chrome plate.
12. Controlled packing compression with metal to metal contact.

36 YEARS' EXPERIENCE T-J

TOMKINS-JOHNSON

RIVETERS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHERS

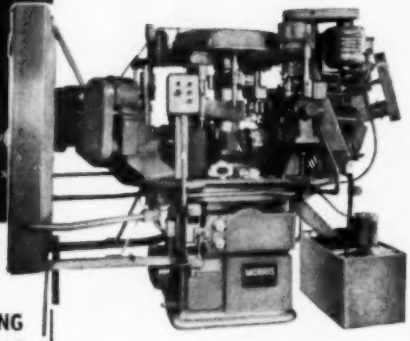
. . . REPLACED 6 OLD MACHINES PAID FOR ITSELF IN 39 WEEKS!



Thirty-eight drilling, reaming, countersinking, radius forming and tapping operations are performed on refrigeration parts by this Two-Way Horizontal, Eight Station Automatic Indexing Machine. Production rate is 150 pieces per hour at 80% efficiency.

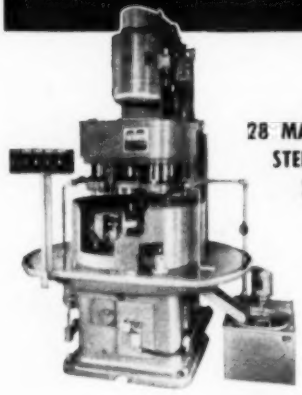
Want PRECISION PRODUCTION LIKE THIS?. . .

. . . 300 PIECES PER HOUR!



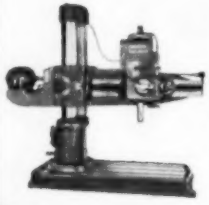
Either right or left hand carburetor air horns are drilled, faced and tapped . . . 22 operations . . . at a production rate of five per minute on this Six Station, Vertical Center Column Machine.

28 MACHINING STEPS IN 18 SECONDS!



Drilling, countersinking and reaming torque converter pump hubs, this Six Station Automatic Indexing Machine turns out 200 pieces per hour for a noted auto manufacturer.

Eliminate multiple handling and multiplied cost in multiple drilling, reaming, tapping and similar operations with Morris MOR-SPEED Production Machines. Morris Engineers will gladly prove that high precision production can be yours . . . with worth-while savings in time, labor and space. Write for additional details.



Morris also builds a line of 9 and 11 inch Column Radial Drills with outstanding features contributing to easy operation, sustained accuracy and long service life. Catalog on request.

Canadian Representatives:
THE JOHN BERTRAM & SONS CO., LTD.

Builders of MOR-SPEED Line

"A better product at less cost—with PRODUCTION plus PRECISION"

THE MORRIS MACHINE TOOL COMPANY

933 HARRIET ST., CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Sensible Plan for Guns and Butter

It is high time that intelligent planning be done to set up defense production on a practical permanent basis.

Washington has confined its thinking, up to now, largely to a short-term program. It has been concerned, and rightly, with the problem of securing defense material in the period immediately ahead, say to 1955 or 1956.

That approach is understandable. We have been up against the hard reality of getting more planes and guns and tanks soon.

But if the defense job is to be done sensibly and with a minimum of waste, it should be tied in with long-range planning.

That means, in effect, that we should give close attention to working out one of the most vexing problems of all—how to build up an adequate permanent defense production establishment.

That establishment should be able to produce whatever the military requires currently. It also should be capable of quick expansion of output in case of all-out war or threat of war. And it should not dominate our economy in peacetime, but dovetail into it.

We are happy to report that Washington, for the first time, is working earnestly on this problem. Details are outlined in this issue on page 73.

The plan is essentially to tool up plants for basic types of weapons—jet engines, planes, guns, tanks—so that they can turn out military needs during the cold-war period on a single eight-hour shift five days a week.

These plants would have sufficient "overtooling" to meet needs of a hot war by running round the clock six days a week and operating the excess installed machines.

Beyond that, a pool would be built up of "bottleneck" machines which normally take nine months to a year to produce. The pool purposely would be conservative in size.

Measures to keep the machine tool industry sturdy are part and parcel of the plan. At long last, Washington rightly regards the machine tool industry as an invaluable defense asset.

A special commission is being created to study the entire far-reaching plan and to make recommendations as to how it can best be carried out.

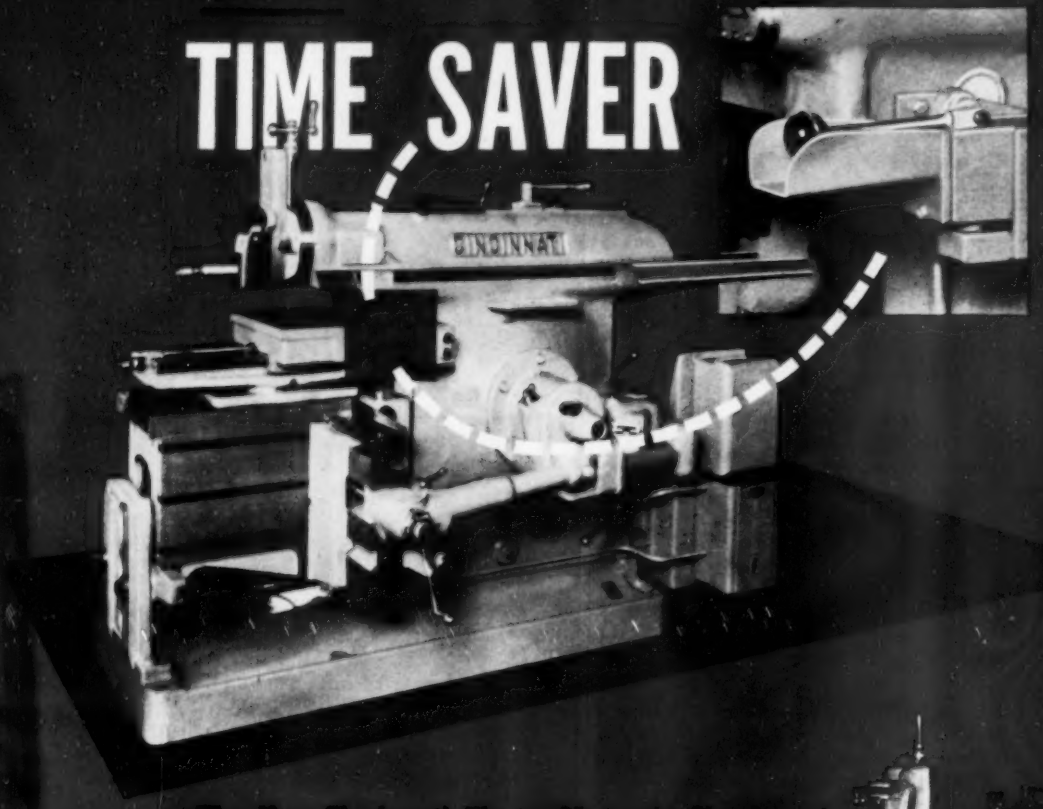
This is a laudable start in the right direction. The plan deserves the best thinking and cooperation of American industry and of people in high circles in Washington, including the Pentagon.

It is a much more practical and workable plan than the idea of stockpiling machine tools which was suggested earlier. If the details can be smoothed out, this plan may solve the problem of having both guns and butter on a long-term basis without wrecking our economy.

Burnham Finney

THE NEW

TIME SAVER



The New Cincinnati Electro-Magnetic Clutch and Brake alone brought a 30% time-saving here . . .

Starting and stopping are always non-productive, but where starts and stops are numerous and cutting time is a very small part of the entire work cycle, starting becomes a serious time waster.

The New Cincinnati Magnetic Clutch and Brake, with its simple, convenient control lever, converts these time lists into productive time. It gives the operator the fastest, simplest and most accurate control of the shaper.

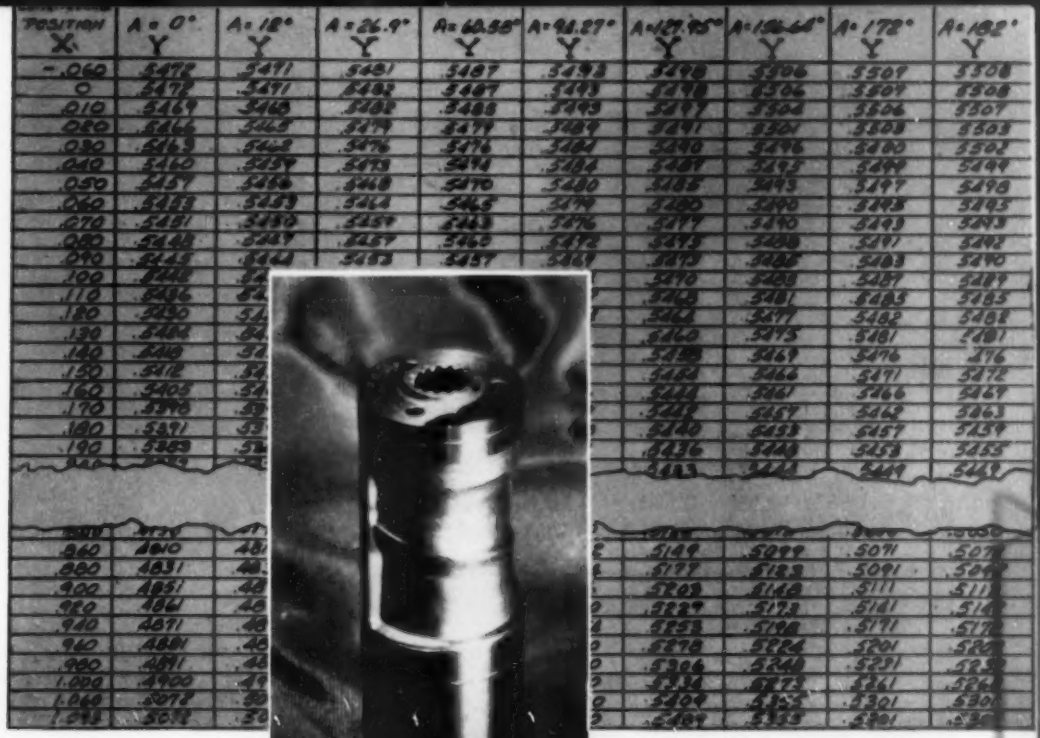
This powerful clutch and brake requires no shutdown for adjustment, and has a long, maintenance-free life, time-saving and profitable features.

Write for Catalog F-3 for the complete line.

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES



POSITION X	A = 0° Y	A = 18° Y	A = 26.9° Y	A = 60.58° Y	A = 98.27° Y	A = 127.95° Y	A = 154.46° Y	A = 172° Y	A = 182° Y
-.060	.5478	.5471	.5481	.5487	.5493	.5498	.5506	.5507	.5508
0	.5478	.5471	.5482	.5487	.5493	.5498	.5506	.5507	.5508
.010	.5469	.5460	.5468	.5488	.5493	.5497	.5504	.5506	.5507
.020	.5464	.5455	.5479	.5479	.5489	.5491	.5501	.5503	.5503
.030	.5463	.5458	.5476	.5476	.5481	.5490	.5496	.5500	.5502
.040	.5460	.5459	.5473	.5474	.5484	.5489	.5495	.5499	.5499
.050	.5457	.5456	.5468	.5470	.5480	.5485	.5493	.5497	.5498
.060	.5453	.5459	.5464	.5465	.5479	.5480	.5490	.5498	.5493
.070	.5451	.5460	.5459	.5463	.5476	.5477	.5490	.5493	.5493
.080	.5448	.5457	.5457	.5458	.5472	.5473	.5488	.5491	.5492
.090	.5445	.5454	.5453	.5457	.5469	.5473	.5488	.5483	.5490
.100	.5448	.54				.5470	.5488	.5481	.5489
.110	.5436	.54				.5468	.5481	.5483	.5485
.180	.5450	.54				.5464	.5477	.5482	.5488
.130	.5462	.54				.5460	.5475	.5481	.5481
.140	.5446	.52				.5458	.5469	.5476	.476
.150	.5412	.54				.5482	.5466	.5471	.5472
.160	.5405	.54				.5224	.5467	.5466	.5469
.170	.5398	.53				.5247	.5457	.5462	.5463
.180	.5391	.53				.5240	.5453	.5457	.5459
.190	.5383	.52				.5436	.5449	.5453	.5455
.200	.5376	.52				.5433	.5444	.5449	.5449

.960	.4910	.48				.5149	.5099	.5071	.507
.980	.4891	.48				.5177	.5123	.5091	.509
.900	.4851	.48				.5203	.5146	.5111	.511
.920	.4841	.48				.5229	.5173	.5141	.514
.940	.4871	.48				.5253	.5198	.5171	.517
.960	.4891	.48				.5278	.5224	.5201	.520
.980	.4911	.48				.5306	.5249	.5231	.523
1.000	.4900	.49				.5334	.5273	.5261	.526
1.060	.5072	.50				.5409	.5352	.5301	.530
1.240	.5072	.50				.5409	.5353	.5301	.530

This 3-dimensional master control cam, shown here actual size, cost an aircraft-instrument manufacturer $2800—and the charge was reasonable. For the reasons, read the accompanying article

Columns on this drawing begin to explain the problems. They are all dimensions for points on the approximately 1 sq in. of cam surface. Each vertical column provides dimensions along a radial plane through the axis at a given angle of rotation from base plane

SUPER "NERVE CENTER" CAM

HAS 720 EXACT STATIONS ON 1 SQ IN.

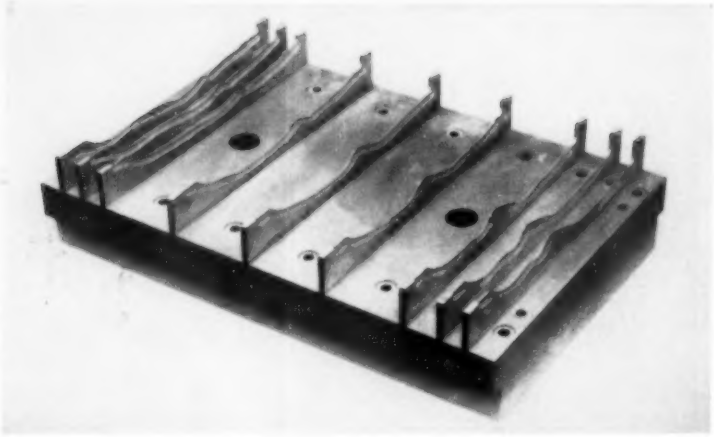
Master control cam produced by ingenious methods meets "impossible" specifications.

Here's the step-by-step story of its manufacture . . .

BY JOHN W. MALLORY, CHIEF ENGINEER, THE PARKER STAMP WORKS, INC., HARTFORD, CONN.

This new "super cam" meets requirements for automatic control of aircraft in flight. The cam takes the form of a hollow cylinder of steel about 1¼ in. in diameter and 2⅜ in. long. Metering or cam area is concentrated in slightly more than a square inch of cylindrical surface. In that area there must be 720 points or "stations", each at a radial distance from the axis exact to less than 5 ten-thousandths of an inch.

How the dimension for each station is determined is not only highly technical and complex but also cannot be revealed for reasons of national security. Suffice it to say that three companies were looking for someone to build a master con-



FIRST STEP in producing the cam is to make this templet assembly five times size. Each templet corresponds to a vertical column of figures on the drawing. Stations were spotmilled on a jig borer, then joined by hand fairing. Templet spacing corresponds to 5X cam peripheral distance

the story behind this story

A pilot flying at supersonic speeds has so many problems in piloting and gunnery that he has no time for the mechanical adjustments so necessary to top performance and efficient operation of his ship. To rely upon human reaction to make necessary adjustments would be disastrous—the emergency would be past and plane and pilot lost (through enemy action or material failure) before his ship could be brought under safe limits of control.

A mechanism to compute instantly and to control automatically top efficiency to a safe value in flight was the answer. Nerve center of that device is a 3-dimensional control cam accurate to 5 ten-thousandths of an inch.

For reasons of national security, the author is spared the difficult task of trying to explain the highly technical functions which determined the cam contour, thus its design. Suffice to say that the contour of the cam is in effect a complex equation representing mathematical computations based upon information gathered in test.

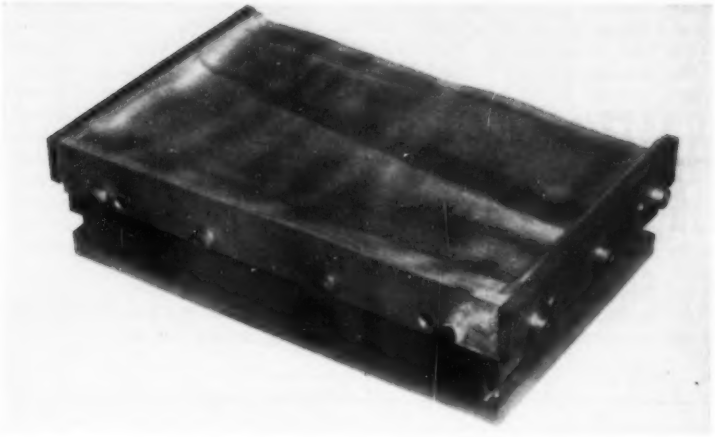
How the master cam—from which control cams will be reproduced—was made, is told in the accompanying story.

trol cam that would meet the specifications. In each case, a country-wide search ended at the same plant: Parker Stamp Works, Hartford, Conn. Parker has produced all three master cams by the same process, although varying processes are used in reproducing from them.

However time-consuming it may be, to establish 720 points on a cam surface is not in itself difficult in a toolroom equipped with accurate machining and measuring equipment. Actual methods of producing this intricate piece could no doubt equal the number of first-class toolmakers in the country. Several such approaches to the problem have been tried.

But because the 720 stations on the drawing were theoretical points determined by computations based on actual engineering test research, it is to be assumed that intermediate points—in fact, the remainder of the cam contours—are likewise essential to its efficient operation. Therefore, it is safest to assume that the whole cam surface, rather than just the 720 points, should function. Accurate stations of transition points between the 720 known stations are infinite. It was with this approach in mind that the method for producing the 3-dimensional cam was chosen.

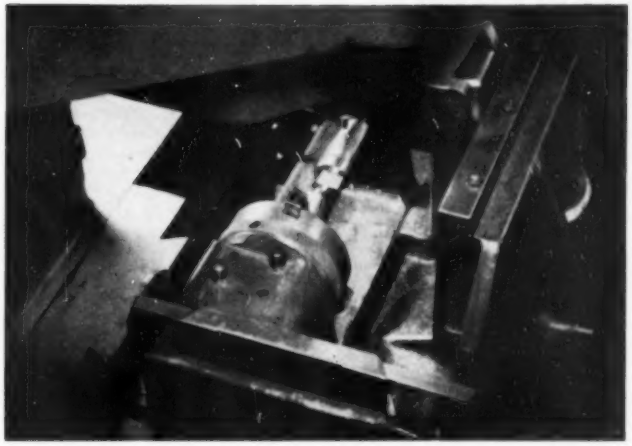
The cam actually has 80 stations on each of nine planes through the axis at various calculated angles of



SECOND STEP is to create this 5X developed model by duplicating with a whiffletree tracer to span two adjacent templets. It was machined within 0.0025-in. tolerances on the cam face, found even closer. Thus tolerance on the one-fifth size copy should be less than 0.0005 in.—and so proved

rotation from a base plane. Assuming the base plane as 0°, the other eight are at 12°, 26.9°, 60.58°, 94.27°, 127.95°, 156.64°, 172°, and 182°—in other words, irregularly spaced. The first major step, therefore, was to make a series of templets, one for each plane. As the final cam must approach perfection, it was decided to make both templets and model five times actual size for accurate checking, then to reduce to actual size in final milling of the cam itself. It also was preferable to assemble the templets in a flat developed contour of the cam surface rather than in a peripheral one, because this made it possible to produce a smooth joining surface between the stations. If the development were peripheral, between angular stations as in the finished cam, further computations would be required, particularly where the angle of rotation was large.

Templet blades were thus set into a flat plate at established lines representing angular locations on a developed surface, and five times as far apart as the peripheral distance on the base circle of the angular locations. Each blade then represented a specific column of figures as tabulated on the drawing, and the face of the plate represented the longitudinal axis of the cam. The 720 stations could then be spotmilled on these blades at five times the actual distances from the axis and at five times the longitudinal spacings given on the drawing. To facilitate the conversion of actual size figures as given on the drawing to figures five times size, this operation was done on a jig borer having extremely accurate leadscrews of 10 pitch. All longitudinal, transverse, and vertical leadscrew dials were recalibrated by covering the original numerals with tape to read 0.0002 in. for every 0.001 in. on the dial.



FINAL STEP is to transfer the developed contour to a cylindrical surface. This special fixture does the job on a 3-dimensional pantograph miller. The fixture is primarily horizontal centers on a floating table held so the axis is always aligned with, and at right angles to, the cutter spindle. Centers are rotated by rack and pinion at one-fifth model-movement speed. Other motions are similarly reduced

Spotmilled blades were removed from the plate and faired by hand filing and stoning between stations. This was easy to do because the 80 stations were distributed over 7 in., never more than 0.3 in. center-to-center, and much closer in critical areas.

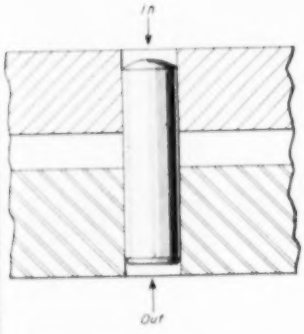
Faired blades were reassembled in the plate, checked, then put on a vertical duplicator as the guide for making the developed model. A 60° cutter with small-diameter nose did the cutting guided by a tracer in the form of a whiffletree generally at right angles to the length of the blades. Thus the trac-

er spanned the space between corresponding stations on adjacent blades, so it was possible to mill a solid surface which had all the known stations of the templets, and had intermediate stations automatically established in addition. The tracer was changed slightly in position as the "hump" area was cut. It was aligned to follow the line of the crest for that portion, to avoid a central "saddle" between templet lines. This resulted in a continuous surface which was the flat development of the cam surface five times actual size. Checking showed inaccuracies to be negligible on this, so reduction by five to one would produce corresponding improvement.

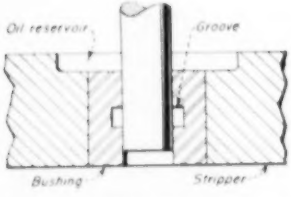
Crux of the whole job was to transfer this developed contour onto a cylindrical surface. A 3-dimensional pantograph miller was the logical machine tool, but a special fixture had to be developed. It consisted primarily of horizontal centers mounted on a floating table held so their axis was always exactly in line with, and at right angles to, the cutter spindle. The centers were rotated through a rack and pinion by relative motion of cutter spindle to worktable—in other words moving the model sidewise rotated the cam through the equivalent angle but only one fifth as much peripheral distance. Vertical and longitudinal movements of the model were reduced 5 to 1 by pantograph action in the usual way. Profiling was done with a 60° cutter with 0.031-in.-radius ball end, and the cut cam hand finished by light stoning. The cam surface was inspected by dial indicate with an 0.062-in.-dia ball to insure proper contact.

DIEMAKERS' KINKS

BY FEDERICO STRASSER

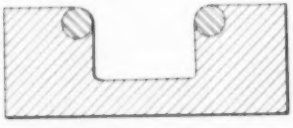


DOWEL PINS are conveniently driven in always from the same side and driven out from the opposite one. To keep the same end upwards, finish one end differently from the other.

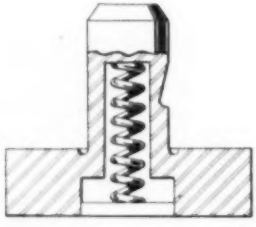


PUNCH LUBRICATION can be effected by counterboring the upper side of the stripper plate and cutting an oil groove in the bushing. Fill the reservoir so made with a light mineral oil.

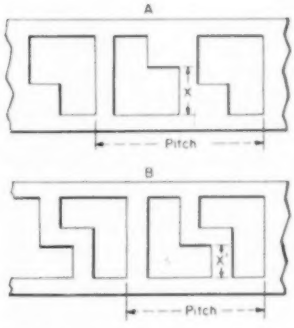
FORMING TOOLS for uneven blanks are made with movable members. When the inner dimension of the formed part must be held constant, the punch is solid and the die members have compensating movements. The reverse is true when the outside dimension of the piece must be held.



WORKING EDGES of forming dies are subject to heavy wear. In some cases removable inserts are used. It is also possible to use hardened rollers to reduce friction.



SPRINGS for actuating shedders, ejectors, etc, require space. Often in small dies it is difficult to find room for them. In such instances, a spring can be pocketed in the punch-holder shank.



PART DIMENSIONS may be changed by collaboration of product designer and tool engineer, so that greater economy in material is realized. In strip layout *A*, dimension *X* prevents close nesting of parts. When dimension was changed to *X'*, the pitch between blanks was shortened.

WORKPIECE DESIGN should take into account the difficulties inherent in press-tool operation. For example: to produce a blank with rounded edges from strip, do not attempt a half circle as at *A*. Choose an arc like as in *B*. Then, any unavoidable irregularities in alignment of punch and strip will not be evident.

STANDARDIZED DIE BLOCKS CUT TOOL COSTS

BY JERRY S. ADAMS, Los Angeles

Die-cast cylinder head for small gasoline engine is produced with sectionalized dies. Sectors here are unusually useful, for they form the integral cooling fins as well as the main sections of the head

Main die block is hogged from solid metal without patterns. Recesses, holes, slots, and channels are provided for assembly of die details inside main cavity, which may be replaced

Templet segments are finished before assembly into main die cavity. These are more easily and more accurately formed to exact contour required than a solid die. Slots at bottom allow assembly with bolts

Take a given line of die products, all similar in design, but with slightly varying dimensions. Instead of making a dozen different dies, one each for each of a dozen different variations of the product, make a single die shell that is large enough and strong enough to contain the largest model. Then make templet-like inserts to fill the die-shell cavity out to the required product shape, and bolt these plates into the die. Attach the die to the press, and go to work.

For a new run on a different model, strip out the templets, locate new ones in place (some may be the same as the others for the first model), bolt up, and start producing again.

There are hundreds of reasons why this cannot possibly work; yet McColloch Motor Corp. of Los Angeles has proved this idea practical in many cases. The idea saves diemakers' time, die steels, and machine time; and it may do the same for other die shops. Standardization is essential, according to McColloch engineers, to introduce new economies into the die shop. Where molds or dies must work on a given machine, most of the external dimensions and fittings must be the same. The details of the mold cavities may not be the same, but why duplicate die shells when you can change dimensions and forms closer to the product than outside the die?

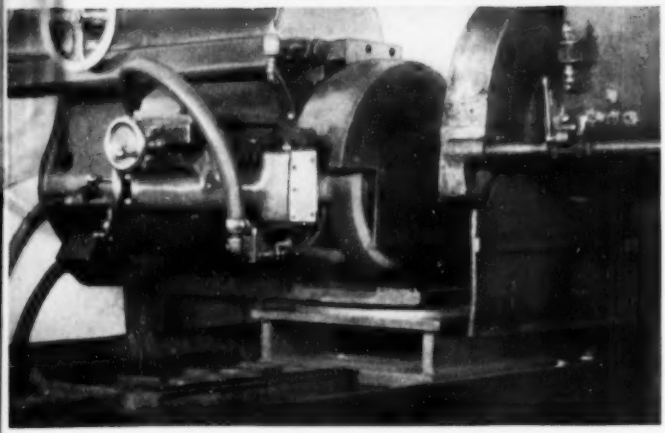
Die blocks, made along the idea expressed above, save more than half the material cost of each new mold, and all of the labor and machine time usually required for working the outside surfaces of molds.

Casting is being done in magnesium, which calls for high pressures. Even though auxiliary injection equipment is required for the presses, the molds themselves work as well as the solid type.

BY R. R. BALDENHOFER, Works Manager
THOMPSON GRINDER CO., Springfield, Ohio

EIGHT WAYS TO GRIND

Proved methods for producing accurate hardened and ground ways often can replace costly hand-scraping operations or slow single-cut grinding methods . . . Here are representative setups for grinding ways on both large and small machines



1..DUPLEX MACHINES FOR WAYS OF DIFFERENT HEIGHTS

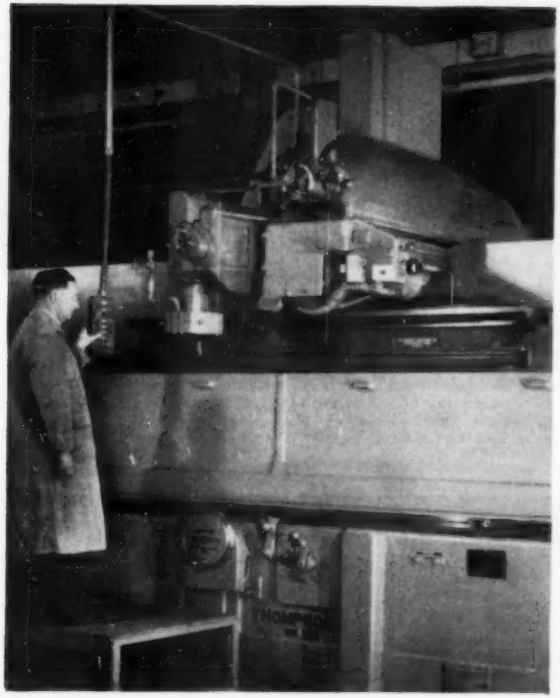
Double adjustable heads permit simultaneous grinding of machine-tool ways of considerably different height. Each head operates independently of the other. Vertical feed is automatic; cross feed is manual. Piece being ground is wheel-head slide for Landis Tool Co. cylindrical grinder. One wheel is form-dressed, the other is straight. Job is ground to final finish in one setup

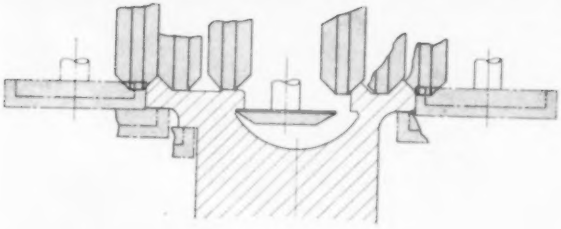
SHOULD YOU SELECT PERIPHERAL OR CUP WHEELS?

A familiar question is whether the finish from a peripheral grinding wheel is superior to that of the cup wheel. Experience indicates that the same rms factor and the same percentage of bearing can be obtained from either type. While some contend that more surface oil reservoirs are created by the cup-wheel finish, it appears that for the same rms factor, the same amount of oil can be held by either finish. If a critical "stick-slip" condition exists between two moving members, one or both having been ground, it then becomes necessary to break up the bearing on one part.

Much greater production, of course, can be obtained from a large-diameter peripheral-grinding wheel in a setup such as that shown in No. 4, than if each face were to be ground individually with a cup wheel. In this case, the time for grinding the top bearings only is approximately 1/10 that required if a cup wheel were used for the same operation. However, in many cases, the design of the part requires both wheels to grind the piece in one setup.

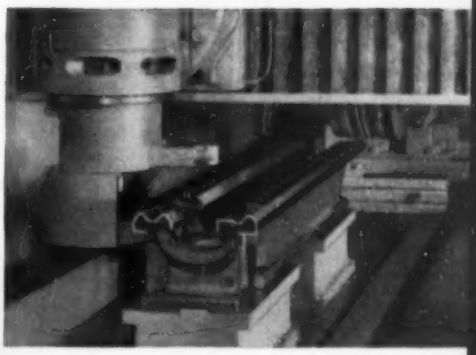
MACHINE-TOOL WAYS





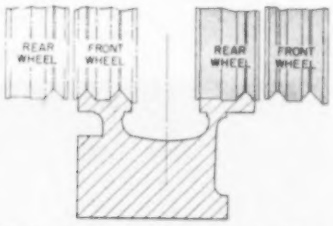
2..GRINDER WITH AUXILIARY SPINDLE: PARTICULARLY FOR LATHE BEDS

Auxiliary vertical spindle permits grinding all way-surfaces plus carriage and tailstock gib-ways and carriage-rack seat in one setup. This eliminates separate re-machining ordinarily required when integral ways are surface-hardened. Peripheral wheel is form-dressed to 90° included angle for grinding top V's, flats, and sides of V's. Wheels do not grind simultaneously. Job shown is at the Hendey Machine Co. Crest of peripheral wheel also can be trued with two flats and a concave radius for grinding radius on crest of V bearing

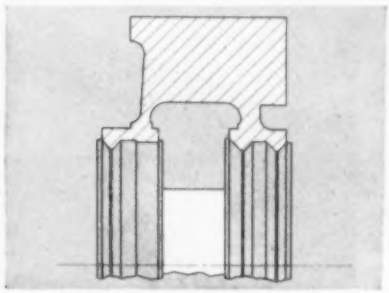


3..FORMED WHEELS..HEAD SHIFTED

Grinding the full contour of ways is performed with two or more formed wheels mounted on the same spindle. Automatic truing device retrues wheels at end of table stroke while new beds are being loaded on grinder. No measuring is required as machine has automatic downfeed, spark-out, and size control. Changes from one type bed to another only require changing wheel arbor-assembly and cams of truing device. Truing of this type is limited to the smaller V-ways. Automatic stops position wheelhead in correct relation to each way

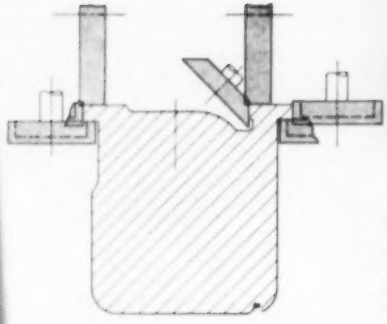


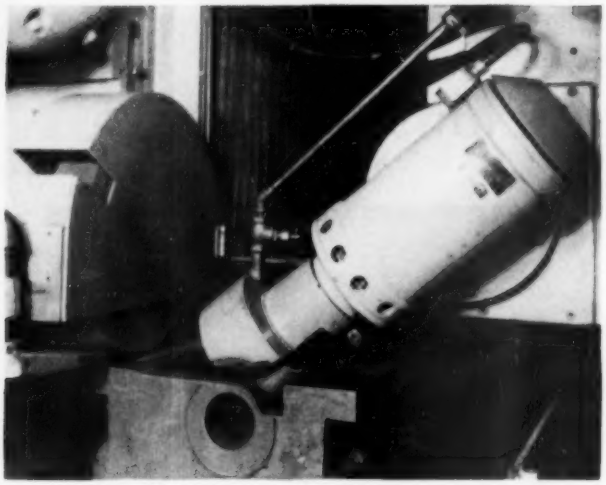
Grinding of one way at a time is done with wheels as shown. Automatic stops position wheelhead in correct relation to each way. Approximately 0.0005 in. is removed per pass and 6 mu-in. rms finish can be obtained if desired



4..FORMED WHEELS..PLUNGE CUT

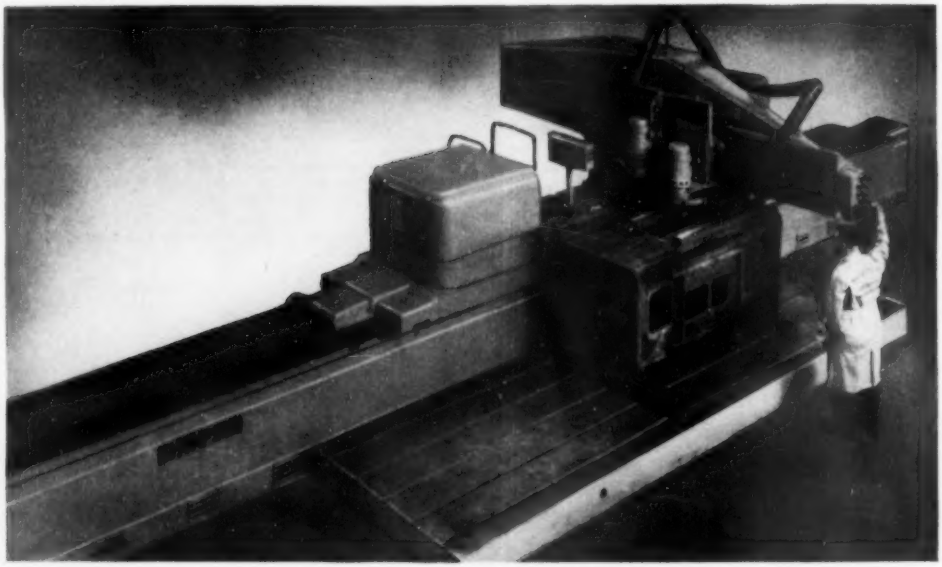
Grinding of both ways simultaneously can be done if spread of ways is not too great. Plunge cut finish-grinds all dimensions





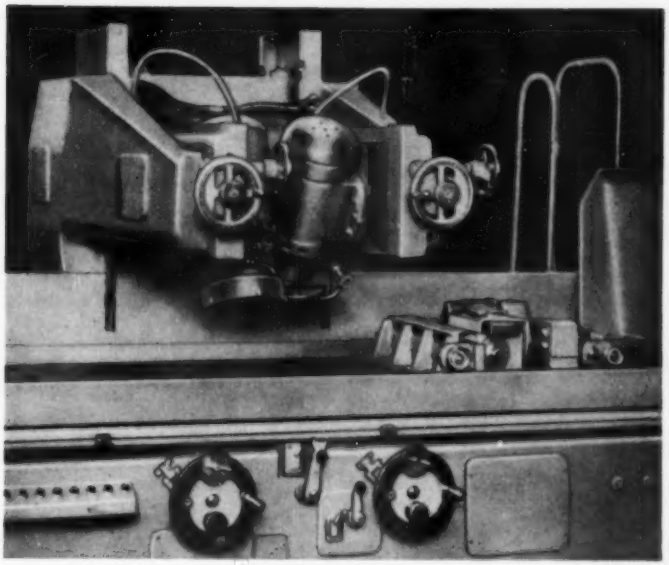
5..GRINDER WITH SWIVELING HEAD

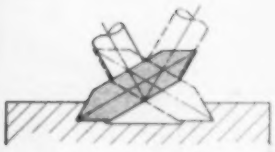
Grinding in restricted areas on large machine tools is possible with formed wheel on machine with swiveling head. Large column shown, is ground on all bearing surfaces in same setup. Present floor-to-floor time is 3 hr compared to previous time of 14.5 hr for scraping. Additional 1.2 hr is saved because of broader permissible planer tolerances. On this job, swiveling head operates in both vertical and angular positions

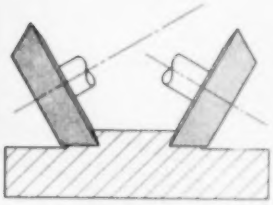


6..TRAVELING-HEAD GRINDER WITH CUP WHEELS

Work rests on floor plate and must be accurately aligned with moving head of grinder. As machine is primarily a dry grinder, using cup wheels, stock removal must be held to a minimum. Traveling rail is driven up to 50 fpm, which is maximum safe reversing speed when operator rides on machine

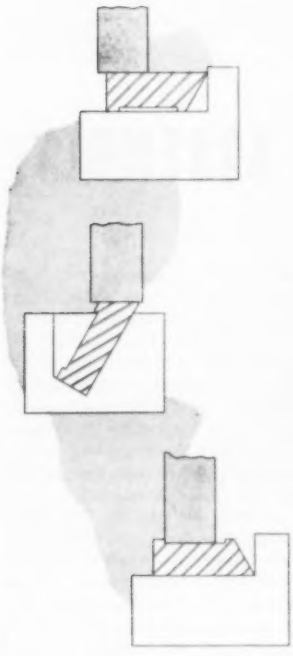


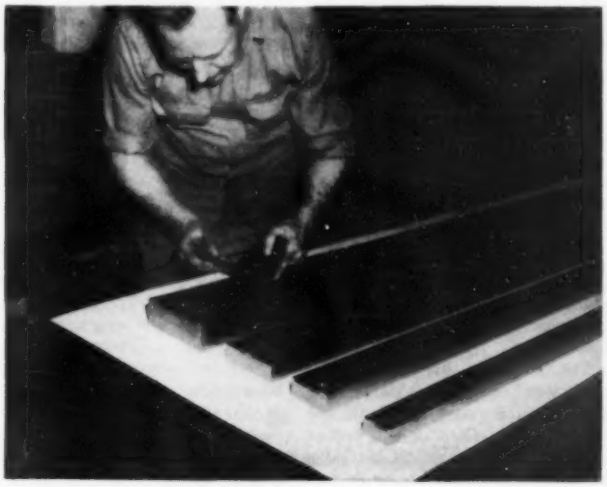




7..SPECIAL MACHINE FOR DOVETAIL WAYS

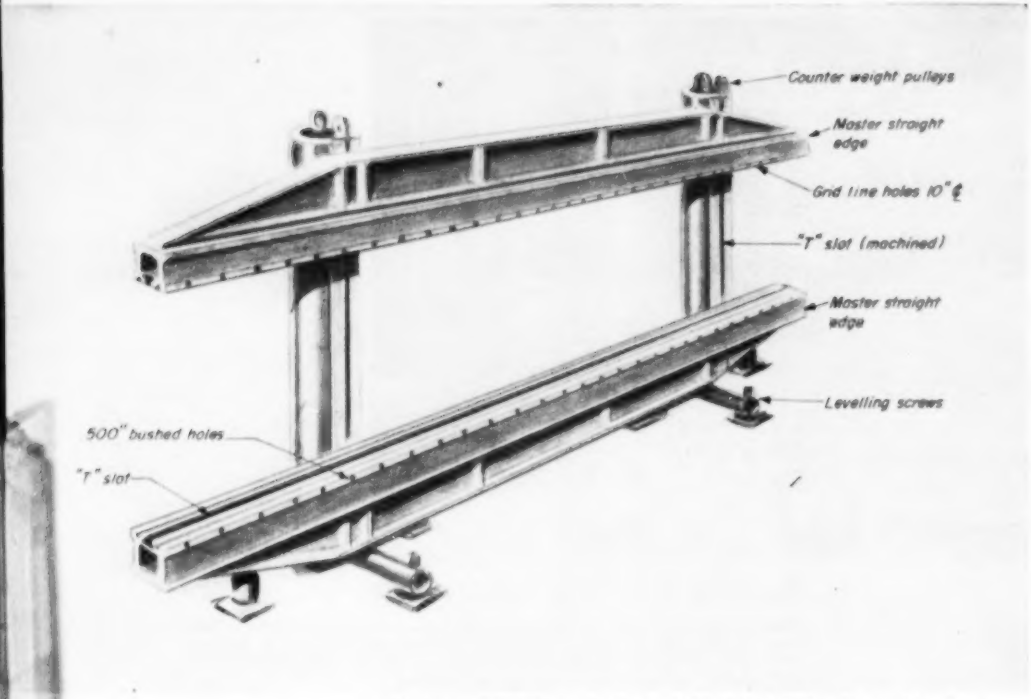
Male or female dovetails can be ground with formed wheels and independent wheelheads. During loading, each wheel is trued automatically to finished work-size. Positive stops eliminate measuring and give setup that grinds uniformly to machine-tool accuracy requirements





8..GRINDING HARDENED INSERTS FOR MACHINE-TOOL WAYS

Hardened inserts for beds of Gisholt turret lathes are ground in fixtures so designed that ways lay in normal position so any distortion is ground out. After rough grinding to within 0.010 to 0.012 in., pieces are finish ground in same fixtures to tolerances of 0.0005 in. in 14 ft and surface finish of 6 to 10 mu-in. rms



Master paneling fixture, as developed by Leland A. Bryant, consists of two vertical oil-pipe casings mounted on four legs made by welding-steel tubes. Horizontal positioning is provided by a movable master straightedge at the top and a fixed master straightedge at the bottom. Strip templets provide the form. The device lends itself to optical tooling

BY FRANK CHARITY
Los Angeles, Calif.

MASTER FIXTURES MASTER ASSEMBLY

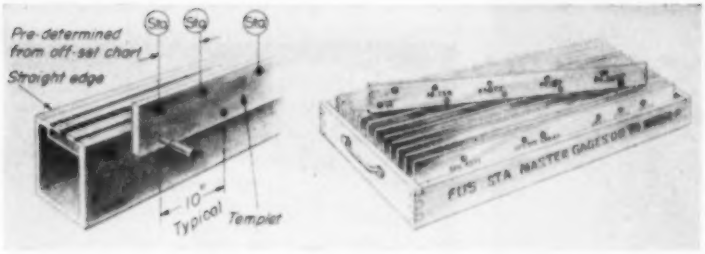
"How can assembly tools be standardized so we will not have to make each new production jig or fixture from scratch?"

The answer to this age-old puzzler saved Consolidated Vultee Aircraft Corp at least $9000 on one job. Briefly, Convair needed a wing tip for a prototype airplane. To construct a conventional production assembly fixture would have cost $25,000 and several hundred manhours. Even making the wing tip without a special fixture would have cost $10,000, plus some additional headaches. Instead of either method, engineers converted a master paneling fixture into a wing-tip assembly fixture of satisfactory quality. The entire change required only one hour and cost less than $1000. Subsequently, the necessary engineering changes were made in the master fixture to permit its use for production until a conventional assembly tool was completed. The master fixture also served as a guide to the designer of the production assembly tool.

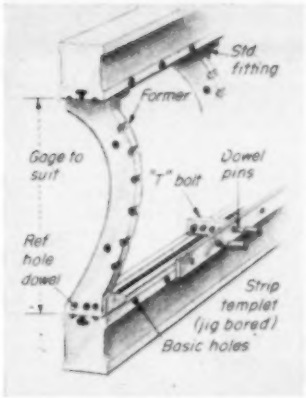
Designwise, the fixture is an inexpensive tooling structure which is assembled with a variety of individual locational elements to facilitate the assembly of prototypes.

Structurally, the fixture consists of two vertical sections of oil-well casing (large pipe) and two horizontal straightedges. One of the straightedges is rigidly fastened, at both ends, to the lower portion of a vertical member. Directly over this, the second straightedge is mounted so it can be manually elevated or lowered by the use of a cable-pulley device, balanced by a counterweight within each of the vertical casing members.

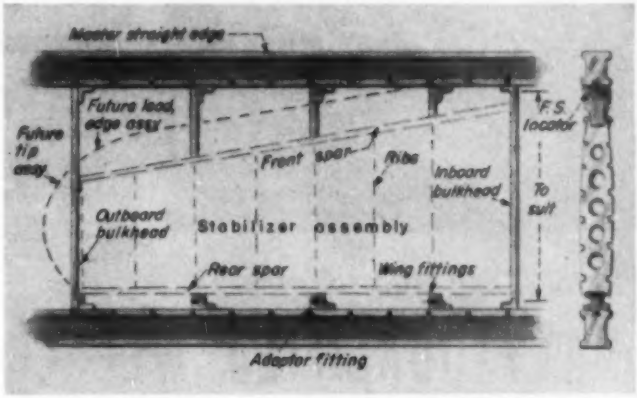
Locking devices on the upper straightedge and vertical members make it possible to space the horizontal fixture elements to suit the lengths of the various locators required for assembly. Only these locators need be changed to adapt



Strip templet is used to determine acurately the station location along the straightedge of both the master paneling fixture and the master tooling dock. Microbars can be used to increase the speed of setup. Lower holes are spaced 10 in. apart for mounting on straightedge; upper holes are positioned to locate stations. Holes are jig-bored. Templet blanks are ¾ in. thick by 2 in. wide by 51 in. long



Details of fixture set up for prototype of airframe panel. When upper straightedge is properly positioned and adapters have been assembled on both straightedges, locators can be rapidly and accurately bolted in



Particularly successful in the assembly of prototypes, the master paneling fixture greatly reduces the cost of engineering changes while providing high-quality tooling. Setup time for this airframe stabilizer is only one hour; changes are made in minutes. Fixture can be used for airframes, automobiles, railway cars, boats, and many other structures

TROUBLES

Standardized, reclaimable assembly fixtures can save time and money; can remove production bottlenecks. Leland A. Bryant, who claims credit for developing the "Tooling Dock," has specialized on this problem. His findings are described here.

the fixture to an infinite number of assembly operations.

To simplify positioning locators, each straightedge has:

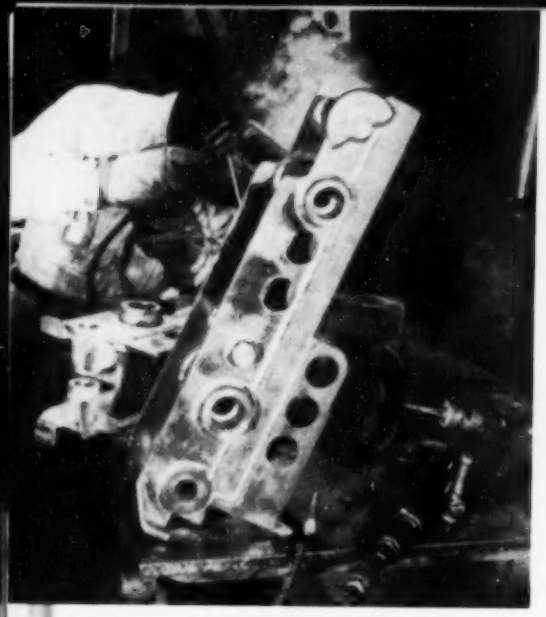
1. A sequence of tooling holes jig-bored on one edge at precise 10-in. intervals and extending lengthwise from one end to the other. The holes allow strip templets to be used and also a microbar. The latter is similar to that used with the tooling dock to establish each locator station on each straightedge with a dimensional tolerance of 0.005 in. or smaller.

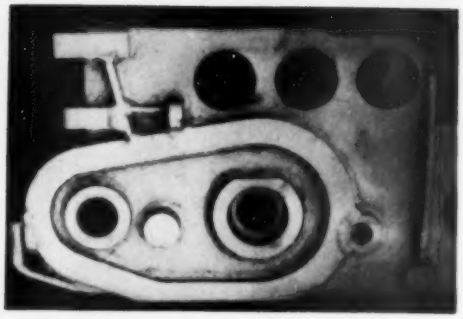
2. A T-slot (on the top surface of the lower straightedge and the bottom surface of the upper straightedge) in which an adapter fitting can be assembled at each station position. This fitting provides a hole to permit one end of a locator to be bolted to the tooling structure at a specified station.

Strip templets locate stations for maximum dimensional control. When maximum speed of retooling is necessary, a microbar can be used. This tool consists of two steel pieces, one with holes at 10-in. intervals suitable for mounting like a strip templet, and the other with a sequence of equally spaced station holes. The latter piece is adjustable front and rear so any of its station holes can be used to position an adapter fitting when properly aligned to a station with a micrometer.

A T-slotted strip of steel on each of the vertical components permits the use of T-bolts to hold the upper straightedge in parallel alignment with its mate. Leveling is provided by screws in each of the four welded pipe legs.

Wide use of these fixtures as reclaimable tools for production purposes would require a number of refinements in the design described. The economic advantages of this tooling could quickly be cancelled by the constant need for tool proofing in large-scale manufacturing.





Gear-case weldment consists of ¼-in. thick low-alloy steel sheet combined with heavy-section mild steel bosses, hubs, and blocks. Job was done by ac arc welding at up to 300 amps. First, a number of tests were run to determine weld shrinkage at various functional points, then parts were tack-welded in place, checked, and finish welded. Care permits finished faces to be cleaned up with very little machining. Portable power tools simplify cleaning of surfaces and avoid extra handling

NAVY-QUALIFIED WELDERS PRODUCE INTRICATE PARTS

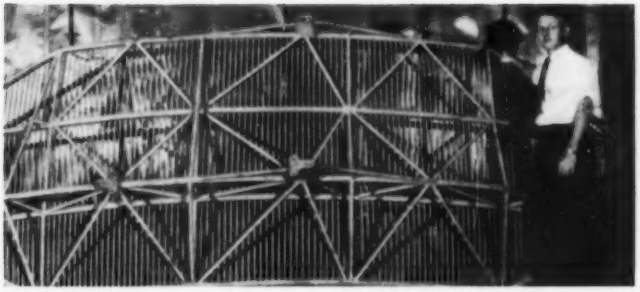
By H. J. BOLL, Method Research Engineer
AMERICAN MACHINE AND FOUNDRY COMPANY,
New York, New York

Contract shops are constantly called upon to fabricate increasingly diversified and complex parts. Numerous grades of steel, as well as aluminum, magnesium, and other metals, are called for. One method used to produce unusual shapes quickly is welding. But each material specification calls for different welding techniques and variations in equipment.

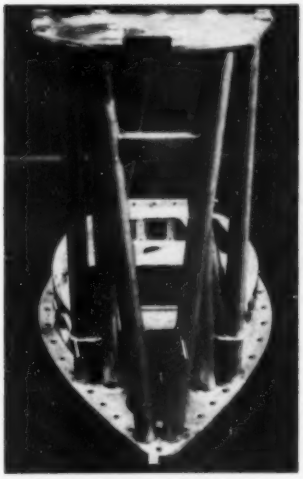
To minimize the possibility of part failure, the Army, Navy and Air Force require that all welders working on their contracts be certified by them. Recertification tests are also conducted periodically to insure a continuance of high performance standards. Tests can be requested through local military procurement offices.

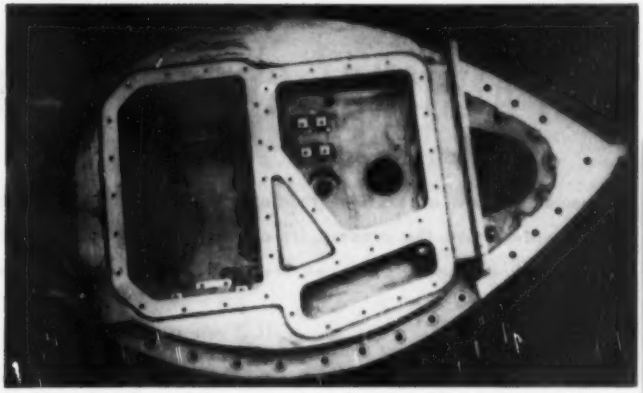
American Machine & Foundry Co. manufactures automatic cigarette makers, cigarette packers, cigar machines and a host of special devices for the Armed Forces. Much of this work requires superior welding abilities and facilities. All of the welders are certified and some of their methods are shown.

Steel tubing (4130) 0.049-in. wall by 1.0 in. OD, is joined with solid 4130 steel bosses by oxyacetylene welding. Job had to be entirely free of welding faults, irregularities, and distortion. Work was done in draught-free room; part was pre-heated and then replaced in oven after each joint was welded. Upon completion, piece was slow-cooled in oven. Hydrogen was used to shield the weld zone; thus prevent absorption of moisture



Small vertical tubes are closely spaced to a tolerance of less than 1/64 in. on this large all-welded frame. Structures of this kind are made in both aluminum and magnesium. To insure an airtight, leakproof, structure, small holes are drilled in joints before welding to form a continuous air passage throughout structure. Air pressure is then applied at some convenient point and each joint is checked for leaks. Small tubes are templet positioned

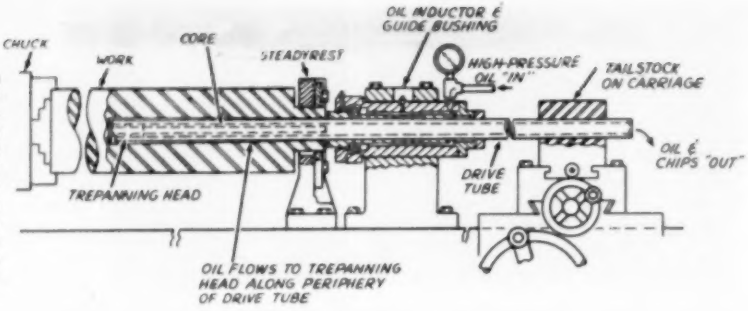




Complex aluminum weldment, 4½ ft high, consists of sheet, plate, and tubes. A high-frequency ac welder using argon (inert-arc) as a shield was used. Shrinkage was previously determined and allowed for. Argon eliminated need for flux, which cannot be used on aluminum or magnesium as entrapment within weld or structure will cause corrosion of the joint

Sub-surface defects, such as porosity, cracks, slag inclusions, or lack of fusion are shown by production x-ray. Here inspector examines film for welded-steel castings previously described. Most highly stressed weldments require radiographic inspection

Production "Magnaflux" is used on all steel weldments. This piece was made from two steel castings, welded through center longitudinally, top and bottom. Part is magnetized by holding two electrodes against work, one on each side of weld, and passing current between them



Schematic of a deep-hole boring machine converted for trepanning. The carbide-tipped head, mounted on a non-rotating driving tube, cuts a cylindrical groove, leaving the center of the hole to be removed as a solid core. Oil under pressure removes chips through the space between the bore of the tube and the core

TREPANNING SPEEDS PRODUCTION OF

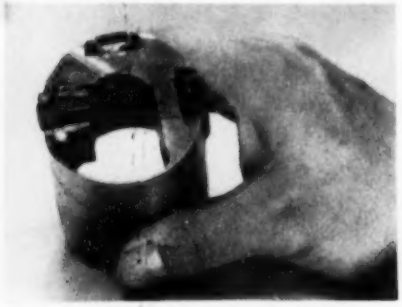
Trepanning is a fast, accurate, method of removing metal in production of deep holes. Here are described the process, its advantages, design of trepanning cutters, correct feeds and speeds, and conversion of conventional machines for trepanning

Trepanning—the process of boring reasonably large holes by cutting a cylindrical groove and removing the center as a solid core, instead of removing all the metal within the bore in the form of chips—is at once one of the most modern and one of the oldest known methods of machining. Certainly the Egyptians, at the height of their civilization, performed brain operations by cutting a disk out of the skull (which was replaced after the operation was completed).

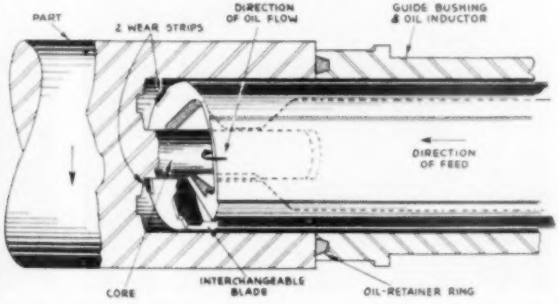
Only in recent years, apparently, has the principle been applied to the machining of accurate bores in metals. Of particular interest at present is application of the process to the drilling of gun barrels at a rate impossible with boring tools or conventional spade drills. Holes up to 30 or 40 ft or more in length, and up to 4½ in. in dia, have been produced in steel forgings in this manner, maintaining tolerances of only a few thousandths as far as concentricity and diameters are concerned.

Advantages of Trepanning

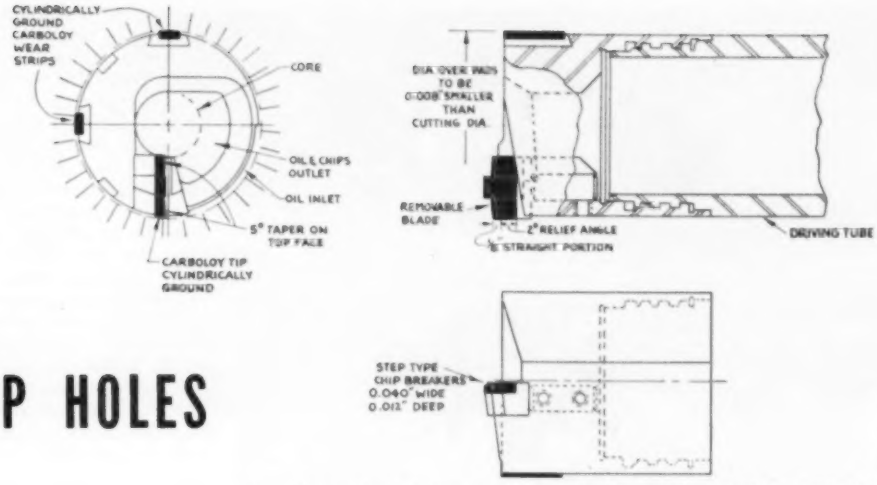
Advantages of the process, however, are not confined to deep holes. It may be applied equally well to the machining of through holes in such parts as gear forgings, with considerable reductions in machining time. In general, accuracy will be higher than when drilling, pro-



Typical trepanning head for producing holes in gun barrels. High production rates and considerable accuracy are obtained as far as diameters and concentricity are concerned



Trepanning head slightly retracted after starting a cut. This cutter head, employing a ¾-in. blade, is used for holes 8 in. or less in diameter. The cutter blade and wear strips project slightly beyond the OD of the head to provide a passage for the coolant to the cutting area


CYLINDRICALLY GROUND CARBOLOY WEAR STRIPS
CORE
OIL & CHIPS OUTLET
OIL INLET
5° TAPER ON TOP FACE
CARBOLOY TIP CYLINDRICALLY GROUND
DIA OVER PADS TO BE 0.008" SMALLER THAN CUTTING DIA
REMOVABLE BLADE
2° RELIEF ANGLE
STRAIGHT PORTION
DRIVING TUBE
STEP TYPE CHIP BREAKERS 0.040" WIDE 0.012" DEEP

DEEP HOLES

By FRED W. LUCHT
Development Engineer, Carboloy Dept.
GENERAL ELECTRIC CO., DETROIT

General cutter-head design specifications found most important for successful trepanning operations. In this example, the cutter blade has three cutting edges so three separate chips are produced. The center portion of the cutting edge "leads", and the two sides follow. Each edge has its own step-type chip breaker. Chips must be broken up as small as possible for discharge by the cutting fluid

vided the equipment is satisfactory. Savings in time with carbides, as compared with producing the same hole with HSS drills, may run as high as 95%. Part of this saving, of course, is a result of the higher cutting speeds and feed rates made possible by the carbide tip on trepanning tools. However, the greatest amount of time saved is because far less metal has to be removed in the form of chips.

Trepanning and Carbides

Carbide, of course, is a 'natural' for trepanning, for the following reasons: (1) The long life of the carbide-tipped tool insures continuity of cutting, as well as the maintenance of closer diametral tolerances at the end of the bore relative to the diameter at the beginning. (2) Higher cutting speeds and feed rates are possible with carbides. (3) The trepanning cutter body carrying the trepanning cutter blade must be protected against wear as it bears against the bore of the hole. Here again, carbide strips provide excellent wear resistance. (4) Proper carbide speeds can be obtained over the entire cutting edge of a trepanning tool. (The dead center on a spade drill makes it unsuitable for carbide inserts.)

An idea of the savings possible by trepanning instead of drilling may be had from the following example:

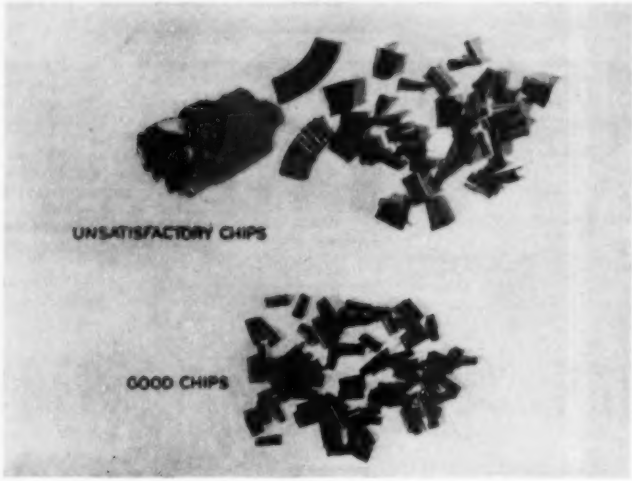
Work—18-ft long, rough-turned steel forging.
Hole—2 13/16-in. dia through.
Feed—0.008 ipr.
Speed—550 sfpm (747 rpm) at outer edge of tool.
Accuracy—Hole held within 0.003 in. for size, and within 0.012 in. for concentricity.

At the speed and feed used, total feed was 6 ipm, giving a total cutting time of only 36 min. This compared with an established drilling time of 15 hr with HSS spade drills, including time for three drill changes.

Converting for Trepanning

At present there are few machines built in this country specifically for trepanning work. However, it is entirely feasible to convert existing deep-hole boring machines or lathes. To convert such equipment, the following requirements must be met: (1) Adequate motor horsepower. In the foregoing example, 46 hp was required. 60 hp or more is usually desirable for good performance, depending on hole size and the material being trepanned. (2) A good flow of coolant. An oil pump delivering 25 gpm or more, at a pressure of at least 175 psi, was required for the job. The volume of oil required will vary, of course, with the hole size. (3) A carriage fixture to support and permit accurate feed of the drive tube on which the trepanning tool is mounted. (4) An oil inductor bushing and support which also provides an oil seal at the entrance end of the bore. (5) Steady-rests to support the work. (6) Centralization of all electric controls and indicators at or near the point of chip outlet. (7) Variable-speed control for the motor. (8) Gearless headstock. (9) Cutting-fluid temperature and oil-pressure gages. Horsepower requirements, of course, are governed by rate of chip removal. The high power generally required is to take advantage of the ability of the carbide to remove metal so rapidly.

Accurate leadscrews are essential to feed the tool at a uniform rate into the work as the work revolves. If a machine considered for adaptation to trepanning has been used a



In trepanning, it is important to produce fairly heavy chips as shown at the bottom of this illustration. This is accomplished by employing the most efficient feed for each particular job. In general, feeds of 0.006 to 0.010 ipr have been found to work very well

great deal for one length of work which required the carriage to move over the same place many times, it may be found that because of leadscrew wear in this spot the screw should be replaced to insure uniform feed over the entire travel of the carriage.

While 175 psi was given as a minimum for oil pressure in the job described above, higher pressures are frequently desirable. Much work has been done already in trepanning with oil pressures as high as 200 to 400 psi. The higher pressure of course, require better oil seals. There are several reasons for the high oil pressures required. First, the cutting fluid must effectively wash out the chips as rapidly as they are formed. A sufficient supply of cutting fluid must also flow rapidly enough to prevent any marked rise in either cutting fluid or work temperature. Finally, the cutting fluid must provide adequate lubrication and cooling for the carbide wear strips; cutting fluid with a 10% sulfur base seems to be quite popular.

Trepanning Cutters

The trepanning cutter head is attached to a non-revolving drive tube. Two types of cutter blades are currently used; a $\frac{3}{4}$-in.-wide cutter blade for holes $1\frac{3}{4}$ in. up to as large as 8 in. in dia, while cutter blades $1\frac{1}{4}$ in. wide have been successfully applied to the trepanning of larger-sized bores. The selection of cutter blade size depends largely on the particular operating conditions and the horsepower available. With the $\frac{3}{4}$-in. cutter blade, oil is fed under pressure to the cutter head through the space between the drive tube and the bore of the hole and is discharged along with the chips through the space between the bore of the tube and the core. With larger cutter blades, the flow is reversed, since it has been found that the discharge of cutting fluid and chips around the periphery of the drive tube is advisable when trepanning larger holes.

Design Considerations

Thus far, the design found to be most satisfactory for $\frac{3}{4}$-in.- wide cutter blades is one in which the cutter blade has three distinct cutting edges so three separate chips are produced. This insures breaking the chips up as small as possible for ready washing out by the cutting fluid. The center portion of the cutting edge "leads" and the two sides follow. Each cutting edge portion has its own step-type chip breaker to break up the chips formed by that portion. Carboloy grade 78 carbide has been found satisfactory for the tip for trepanning any steel within a 200-400 Bhn range. Best material for wear strips also appears to be grade 78.

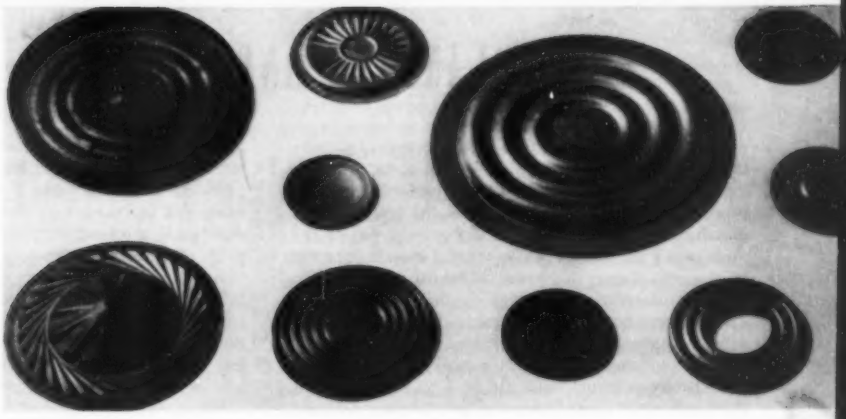
It is important to grind the cutter blade correctly at the start. The blade is cylindrically ground in place after assembly, to a slightly larger diameter than the wear strips, which are also cylindrically ground in position before inserting the blade. Chip-breaker sizes should not be changed when the speed is changed. Chip breakers 0.040 in. wide and 0.012 in. deep have been found to be satisfactory in most applications.

Trepanning Speeds and Feeds

The best cutting speeds range from about 600 sfpm for steels in the 200-250 Bhn range to approximately 400 sfpm for those up to 400 Bhn. These speeds of course, are based on dimensions to the outside edge of the blade and may be somewhat higher for materials of lower hardness.

Feeds of 0.006 to 0.010 ipr have been found to work very well in general, but the feeds best suited for each type of job may require some experimentation. The important thing is to produce a fairly heavy chip because this reduces cutter-blade wear. Chips, however, should be broken up until they are small enough to pass freely through the discharge space. Feed should not be reduced if speed is increased, nor should speed be reduced if feed is increased.

In some instances, although the chips theoretically may be small enough for easy passage, coolant pressure must be increased to flush them out properly. This is especially true when nearing the end of extremely deep holes. In some cases, trouble has been experienced from the passage of extremely fine particles through conventional filters. A special filter employing permanent magnets has been found helpful in such cases by keeping these chips from getting into the pump where they can cause fairly rapid wear, noise and vibration.



Diaphragms frequently are made from beryllium copper because of its high strength, elasticity, and resistance to corosion under most service conditions

How to work with

BERYLLIUM-COPPER STRIP

By
JOHN T. RICHARDS,
Development Engineer
THE BERYLLIUM CORP.
Reading, Pa.

Selection of beryllium copper for a given job is frequently made on the basis of its ability to be severely formed and heat treated to give good spring properties. This characteristic is in contrast to alloys which derive all their strength from cold working, because these usually require some compromise in final properties to meet forming requirements.

Standard beryllium-copper-alloy strip is generally supplied in one of four solution-annealed, or solution-annealed and cold-rolled tempers, and fabricated parts are given a simple, low-temperature heat treatment. For optimum final properties, it is advisable to select the highest temper that will stand the forming operation.

Engineers have sometimes been hesitant to blank springs and other elastic elements across the strip, for fear of loss of strength. However, as indicated in this report, the mechanical properties of fully heat-treated strip are similar in all directions, even though directionality does influence slightly the forming characteristics of the hardest tempers. This means greater economy and freedom of design, because the blank can be laid out in any convenient position consistent with formability.

For successful fabrication it is essential that certain precautions be observed. These are outlined in this Special Report which includes information on press working, heat-treating, soldering, brazing, welding, cleaning, and electroplating. Also given are the engineering properties of the material, and factors to be considered in designing parts to be produced from it.

American Machinist SPECIAL REPORT NO. 304 TO THE METALWORKING INDUSTRIES

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BLANKING AND PIERCING

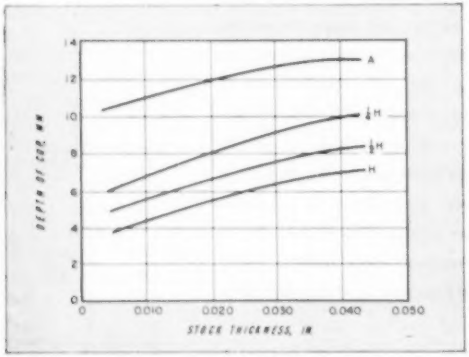
BLANKING refers to the process of punching flat pieces of desired shape from strip, whereas piercing produces holes or irregular openings in flat products. Because the blank takes the shape of the punch, the punch face is usually ground flat to reduce blank distortion, while the die may be ground at a slight angle to reduce blanking pressure. In the case of piercing, shear is applied to the punch.

For blanking, cold-rolled strip is preferred over solution-annealed or dead soft material, as it tends to give a cleaner blank with reduced burr. A clearance between punch and die of 5 to 10% of stock thickness over blank diameter is necessary to limit workhardening and die wear. To prevent burring in soft stock, clearances must be closely held (5 to 6% where possible) and tools kept sharp. Otherwise, heavily workhardened burrs will result, which may seriously affect the life of the stamping, subsequent forming, or the success of fixture hardening processes.

For heat-treatable strip, the shear strength runs approximately 60 to 70% of the tensile strength. For strip of equivalent temper and thickness, beryllium copper offers slightly higher resistance to shearing than either phosphor bronze or brass. In addition, beryllium copper workhardens at a slightly faster rate.

To insure maximum die life, strip should be clean. Cadmium-plated strip gives increased die life and at the same time, provides added lubrication. Die life obtained on beryllium copper is equivalent to that expected from phosphor bronze, but less than normally encountered with brass.

Selection of suitable die material will be governed largely by economic considerations. Carbide dies may be employed for extremely long runs or critical applications requiring smooth finishes or close dimensional control over long periods. For normal production, air-hardening steel is used for long runs, and oil-hardening steel for short runs. To reduce galling or copper pickup, dies should be carefully polished.



Erichsen cup test data for different thicknesses of material indicate the relative formability of the various standard tempers of beryllium copper

Although it is not always necessary to employ a lubricant in blanking, decreased die wear generally results when mineral oil or soap and water are used. Some caution should be observed with oils containing sulfur, as they will stain beryllium copper unless removed immediately.

When the slit edge of the strip does not serve as the blank edge, it is customary to allow a distance at least equal to the stock thickness between blank and edge of strip. In piercing, the minimum diameter is equal to the stock thickness, or at least 0.025 in. Other design suggestions for beryllium copper flat springs and stampings are included under Design Considerations.

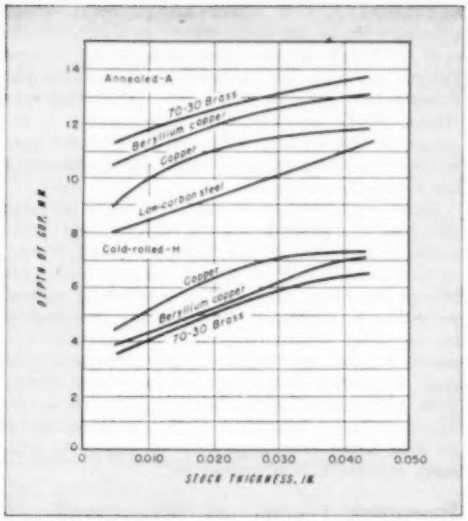
DRAWING

IN DRAWING, the temper selected depends upon the depth of draw. For light work, such as diaphragms with shallow corrugations, it is frequently possible to use quarter- or half-hard strip; however, for deep drawing, solution-annealed material must always be used.

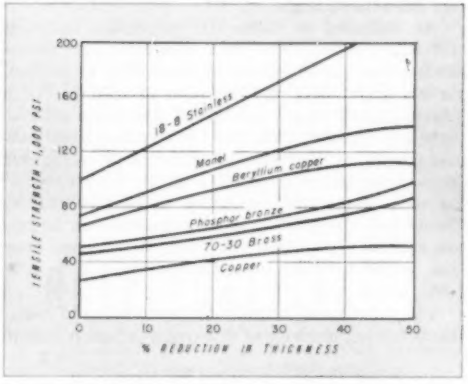
For best results, some compromise in grain size is necessary for critical deep-drawing applications. Fine-grained material may not provide sufficient ductility, while a coarse-grained structure, although ductile, tends to stretch rather than flow in the die, and consequently may break prematurely or leave a rough surface. Past experience, coupled with extensive tests on beryllium-copper strip, indicates that moderate grain sizes offer the best combination of ductility and tenacity.

Rapid workhardening limits the depth in drawing beryllium copper. As indicated in an accompanying chart, the rate of workhardening is not substantially higher than that of other copper alloys; it merely appears higher as a result of the alloy's higher inherent strength. Where excessive depths are required, it may be necessary to include an intermediate anneal between successive drawing operations. Considerable care should be exercised during subsequent cleaning, otherwise excessive die wear may result.

A double-action press and blankholder are preferred over a single-action press, unless the blank thickness is sufficiently great in relation to its diameter to prevent wrinkling. On the other hand, the



Data from Erichsen cup tests indicate the cupping ability of several strip materials in the annealed (A) and cold-rolled (H) tempers



Workhardening rates of several materials compared on the basis of tensile strength

slower forming rate of a hydraulic press, together with a closer control over forming pressure, insures a more uniformly drawn product. Furthermore, it is sometimes possible to draw cups or similar shapes by hydraulic press which it would not be possible to handle in a power press.

Punch and die design for drawing beryllium copper follow phosphor-bronze practice. Because of its slightly higher hardness for equivalent strip tempers, more power, lower speed, and stronger tools are required than needed for deep drawing brass. The clearance between punch and die usually ranges from 5 to 10% of the blank thickness, while the punch radius should not be too sharp.

Die Materials

Die material selection follows blanking practice, so carbide, air-hardening steel, or oil-hardening steel can be employed, depending upon length of run. Carbide or chromium-plated dies can be relied upon to give reduced friction and a better surface finish on the final part, through the decreased tendency to score or plate copper on the dies. Chromium plate is also used to build up worn dies and to protect points of high wear where the use of carbide may not be feasible.

For best results, dies should be carefully lapped and polished to reduce friction. Grinding marks should run in the direction of metal flow. Galling can be reduced by applying proper lubricants and a high polish, while cadmium-plated strip may provide long-run advantages. The importance of a well-polished surface cannot be overemphasized.

Lubricants

Choice of a lubricant depends upon severity of the operation. In many cases, soap and water give good results and can be readily removed by washing in warm water. For the severest operation, it may be necessary to consider lard oil or a heavy soap paste containing solid lubricants to obtain needed film strength. Caution should be observed in using sulfurized oils, as they will stain beryllium copper products unless immediately removed. In selecting a drawing lubricant, some consideration should be given to ease of removal and possibility of staining.

Prior to drawing, care should be exercised to insure that the strip is free from oxide films or scale, otherwise die life may be seriously impaired. Recommended cleaning methods are given below.

FORMING & BENDING

PERHAPS the two most important considerations in forming or bending strip are minimum bend radius and springback. Both are functions of stock thickness and temper, and should be considered at the design stage. Small radius of bend may offer space-saving or structural advantages; however, needlessly small radii may cause production problems. On the other hand, springback influences die design and uniformity of finished part.

A material of reduced formability will crack when formed over too sharp a radius. This tendency decreases as the punch radius is increased, until only an orange-peel effect can be observed. Further increases in punch radius causes the orange peel to disappear. Although orange peel frequently causes an objectionable appearance, its occurrence is not as serious as an open crack and probably does not appreciably affect the life or operation of the part, except in critical applications.

Temper selected for a given bend radius depends on strip thickness and position of bend with respect to grain or rolling direction, as indicated in Table

Table I — MINIMUM RADII FOR FORMING 90° BENDS IN BERYLLIUM-COPPER STRIP

For Heat-Treatable Material up to 0.040 In. Thick

	RATIO, PUNCH RADIUS TO STOCK THICKNESS					
	Without Orange Peel			Without Cracking		
Angle with Rolling Direction, deg.	0	45	90	0	45	90
Solution-treated	0	0	0	0	0	0
Quarter-hard	0	0	0	0	0	0
Half-hard	3.0	3.5	4.0	0	0	0
Hard	4.5	6.0	7.5	0	1.5	3.0

I. The data are based on the minimum punch radius for forming a 90° bend in strip ranging from 0.005 to 0.040 in. thick. For convenience, formability is expressed as the ratio of punch radius to stock thickness. As previously mentioned, directionality, as evidenced by forming characteristics, is in no way detrimental to the final properties of the material.

The relationship between minimum punch radius and stock thickness for strip in half-hard and hard tempers is shown in an accompanying chart. The effect of directionality is indicated by the cross-hatched area, with the upper limit applying to bending 90° and the lower limit 0° to the rolling direction. (In bending parallel, or 0° to the rolling direction, the actual bend or crease is perpendicular or 90° to the rolling direction.) As indicated in Table I, solution-annealed and quarter-hard strip up to 0.040 in. thick can be cold formed to a 90° bend around a sharp radius without cracking or exhibiting orange peel. Some allowance must be made for forming strip over 0.040 in. thick, or bending to angles greater than 90°.

Table II, which compares the formability of several alloys, is offered as a guide in temper selection for those experienced with other copper materials. As indicated, beryllium copper offers a higher level of tensile strength for a given degree of formability. This higher strength level, which generally limits beryllium copper to a 37% reduction of thickness (hard temper) during temper rolling, prevents the occurrence of the marked directionality common in severely cold-rolled materials. Where freedom from directionality is essential in fabricating, either solution-annealed or quarter-hard strip can be specified and age hardened for maximum properties.

Other considerations in forming include the edge condition of the blank and the effect of heat treatment. If blank edges are heavily burred, it may be necessary to employ greater forming radii. Although beryllium copper strip is generally formed prior to age hardening, bending may occasionally be necessary during assembly or operation. Depending upon the temper originally selected, it may be possible to lightly form fully heat-treated strip, particularly in the thinner gages; however, where moderate forming is needed, a special under or over aging treatment may be required, with some sacrifice in final properties.

Springback

Springback is a function of modulus and yield strength. It may be allowed for in die design by over bending, or prevented in pressworking by hitting home, or coining the inside of the bend to set the desired angle.

As indicated in Table III, springback increases for a given thickness with temper, punch radius and, in the case of harder tempers, with an increase in the angle with the direction of rolling. For a given punch radius, springback decreases with an increase in stock thickness. Under normal fabricating conditions, the expected variation in springback runs 5 to 10°. For closer angular tolerances, 2° or less, it may be necessary to consider fixture hardening. Although angular tolerances are largely dependent upon stock thickness and design, they can, under favorable conditions, be held to ± 1/2° with a jig.

The selection of suitable die materials and lubricants follows blanking or drawing practice. Although

Table II — RELATIVE FORMABILITY OF COLD-ROLLED COPPER-ALLOY STRIP UP TO 0.040 IN. THICK *(Minimum Radii for Forming 90° bend in any direction)*

RATIO, PUNCH RADIUS TO STOCK THICKNESS	ALLOY	REDUCTION IN THICKNESS BY COLD ROLLING, %	TEMPER	TENSILE STRENGTH psi	ELONGATION %
0 (sharp radius)	Beryllium Copper (2%)	0	Solution Annealed	63,000	52
	Brass (70-30)	0	Annealed	47,000	62
	Phosphor Bronze (5% Sn)	0	Annealed	47,000	64
	Beryllium Copper (2%)	11	Quarter Hard	79,000	23
	Brass (70-30)	21	Half Hard	62,000	22
	Phosphor Bronze (5% Sn)	21	Half Hard	63,000	28
4.0	Beryllium Copper (2%)	21	Half Hard	86,000	15
	Brass (70-30)	37	Hard	76,000	8
	Phosphor Bronze (5% Sn)	37	Hard	80,000	10
7.5	Beryllium Copper (2%)	37	Hard	107,000	5
10.0	Brass (70-30)	60	Spring	95,000	3
	Phosphor Bronze (5% Sn)	60	Spring	98,000	4

Table III—APPROX. SPRINGBACK OF BERYLLIUM-COPPER STRIP formed to 90° bend

RATIO, PUNCH RADIUS TO STRIP THICKNESS	SOLUTION ANNEALED	QUARTER HARD	HALF HARD	HARD
0	–8	–5		
2	–5	–2	0	8
5	–2	5	10	15
10	5	12	15	25
20	10	25	30	35
50	20	40	50	65

Note: Negative values probably due to a slight degree of coining, consequently value will vary with punch setting.

it may not be necessary to employ a lubricant during forming, its use generally gives longer die life. Chromium-plated dies are sometimes specified. In handling fixture-hardened parts, less expensive dies can be employed, as the final shape is induced by the fixture.

Combined Pressworking Operations

In producing most parts, several pressworking operations are needed. Many springs fabricated from flat strip require both forming and blanking. Diaphragm production may combine drawing with forming and blanking.

Of significance is a recent development in diaphragm production wherein a rubber section is used with a steel half-die. This low-cost tool, good for short or production runs, eliminates the main expense in making conventional dies of matching halves with the proper fit between often complicated ribs or corrugations. Using the rubber technique, only one side of the die is needed, and the material is formed between this and a rubber backing. If the diaphragm has only concentric corrugations, the complete die can be turned on a lathe.

HEAT-TREATING

ALTHOUGH age or precipitation hardening is the result of a two-step thermal treatment, the fabricator will ordinarily be concerned only with the low-temperature hardening operation. The first step, solution anneal, is handled by the mill prior to shipment, and need be considered during fabrication only where it may be necessary to provide an intermediate anneal between severe cold-working operations, such as deep drawing.

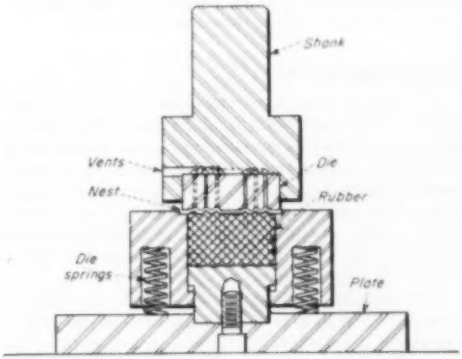
For most applications, the standard aging treatment at 600 F, which requires 3 hr for solution-annealed material, or 2 hr for cold-rolled tempers, is perhaps the most useful. This treatment is easy to control, is not critical with respect to time, and produces the highest degree of strength and hardness. Following hardening, parts can be cooled at any convenient rate.

In the case of certain critical applications, it may be advisable to consider a special aging treatment. By varying hardening times and temperatures, different combinations of properties can be obtained, including conductivity, strength, ductility and resistance to impact. For example, fixture hardening requires a high degree of stress relief, whereas added ductility may be needed for parts which must be bent during assembly.

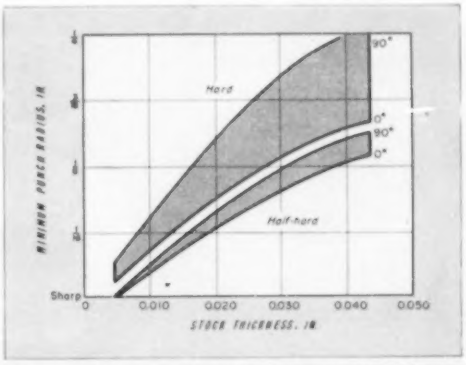
Effect of Temperature

For a given age-hardening temperature, strength and hardness increase with time, reaching a peak and decreasing with additional time. Raising the hardening temperature reduces the time required to reach maximum strength and hardness. Conductivity, on the other hand, increases continuously with time. To obtain special property combinations, some experimentation may be necessary.

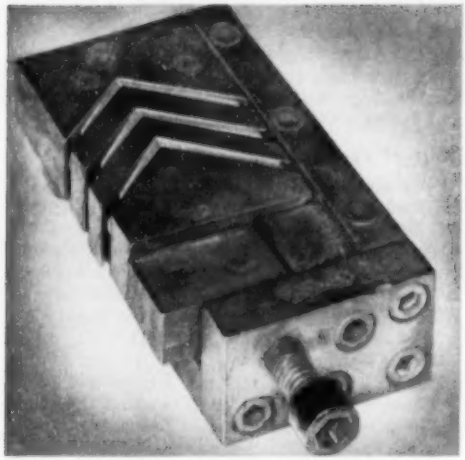
Some allowance may be required for the density change occurring during the precipitation treatment, (see Table VI). The resulting decrease in length should be considered for long or precise parts.



Rubber section below steel half-die makes an effective, low-cost tool for producing beryllium copper diaphragms. Strength of die springs must be selected to hold rim flat while metal is drawn



Minimum forming radii for strip, rolled half-hard and hard. The effect of angle with rolling direction is also indicated for these two tempers



Heat-treating fixture used for producing L-shaped beryllium-copper stampings to close angular tolerances

Fixture Hardening

For springs and small structural parts requiring close dimensional control, a heat-treating fixture may offer economies through the elimination of hand adjustment during assembly. Because of the uniform results obtained, in contrast with other spring materials which spring back after forming, inspection of only a small percentage of parts is generally necessary. At the same time, a fixture makes possible greater freedom of design.

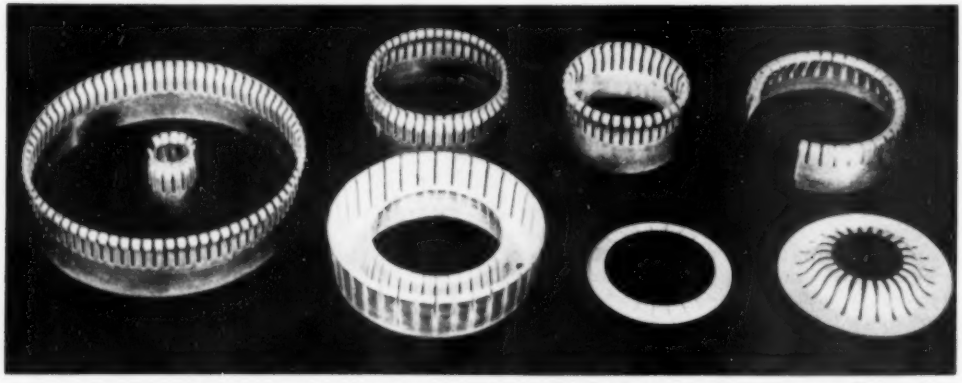
Heat treating in a fixture at a time and temperature selected to give a high degree of stress relief, causes parts to set to the shape induced by the fixture. This means that the dimensional variation in the finished part is limited only by the design and tolerance variation of the fixture itself.

Fixtures made of cold-rolled steel are easier to machine than dies, and do not require hardening. Because the forming face dimensions determine size and shape of the finished part, they must be closely held. Properly designed fixtures will produce small flat springs to a flatness tolerance of ± 0.0001 in., a straightness tolerance of ± 0.003 in., while in blanked and formed parts, angles can be held to ± ½ to 2°. As no allowance for springback is necessary in forming dies, the wide tolerances possible permit considerable die wear and long production runs. This means a further saving through decreased die making and maintenance charges.

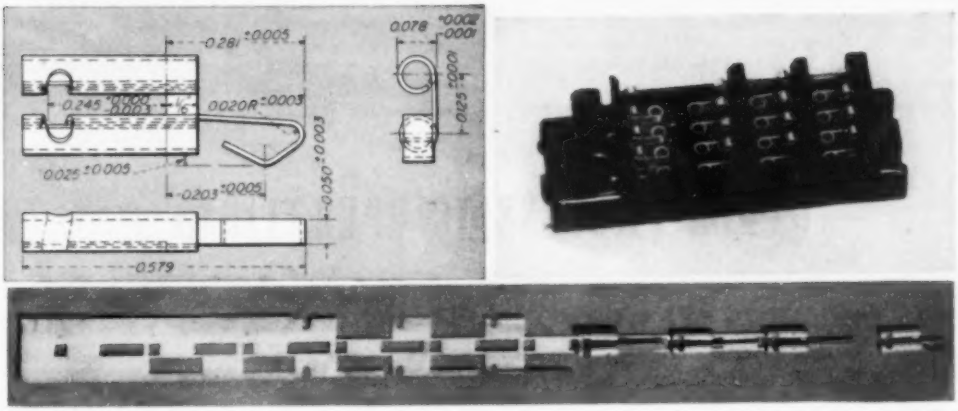
In the two types of fixtures in general use, parts are either stacked or nested side by side. The fixture is held together by bolts or clamps, and dowel pins can be used to provide alignment where necessary. For diaphragms, a stacking fixture may be used in which diaphragms are stacked in series, with separating washers or forms to hold the shape desired. Although in certain critical applications contour-fitting washers may be required, it is usually sufficient to hold only the center and rim of the diaphragm. A clamp holds the stack securely during heat treating.

To obtain maximum return on fixture investment, the highest possible production rate and fixture capacity are important. The higher the heat-treating temperature, the shorter the hardening time and the greater the degree of stress relief and fixture conformity. Because aging temperatures over 700 F usually do not develop full strength and hardness, the treatment selected is frequently a compromise. The more rapid heat transfer offered by a salt bath, compared with an air furnace, may offer advantages.

For best results, fixtures should be completely covered with oil to prevent rusting when not in use, and should be degreased before being returned to service. When used in a salt bath, fixtures should be carefully rinsed, then parts should be removed and rinsed thoroughly, and finally parts and fixtures should be dried. This is particularly important to avoid troubles later on.



Beryllium-copper high-frequency contact rings used for tuning slides and contacts in ultra-high-frequency equipment are fixture hardened to insure truly circular shape and uniform finger pressure



Terminal springs are formed from solution-annealed beryllium-copper strip, 0.008 in. thick. Close dimensional control is needed to eliminate play and insure proper alignment while finished parts are given special heat treatment which hardens and yet permits subsequent bending the ears at the end of the barrel to lock each terminal permanently in place in the molded plastic terminal block seen at upper right

Solution Annealing

Because beryllium copper, like many other materials, hardens with cold work, certain severe forming operations, such as deep drawing, may require an intermediate anneal. Although the immediate purpose of the anneal is to soften the material for further forming, it is equally important that the beryllium be forced into solution so it is available for subsequent hardening. Rapid quenching in water is necessary to retain this structure at room temperature. For best results, close control must be maintained over quenching rate as well as heating time and temperature.

Because heat-treating facilities vary considerably from one plant to the next, it is not possible to suggest solution-annealing times and temperatures to meet all requirements. In most cases, however, good results can be obtained by heating in the range 1450 to 1475 F for 15 to 60 min, with time dependent upon stock thickness and furnace charge. In addition, some allowance must be made for bringing the furnace and charge up to temperature. Parts should be quenched in water immediately after removal from the furnace.

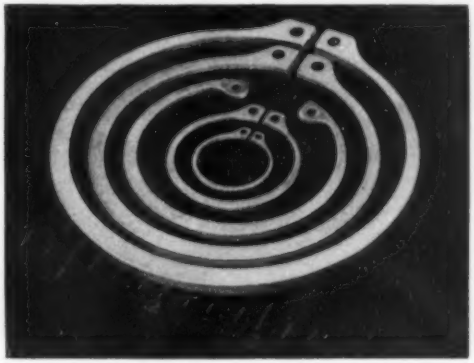
Parts should be free from dirt, oil, or grease when placed in the furnace, and cadmium plate should be stripped prior to annealing. When additional processing follows, the oxide film formed during heating can be removed by pickling, or can be prevented by bright annealing in moisture-free atmospheres. The latter is preferred in many cases, as it avoids an additional operation.

Heat-Treating Equipment

Formed parts may be precipitation hardened in a circulating air furnace, a muffle furnace, or a salt bath. Because the heating rate is slower in a muffle furnace, hardening will require a longer time than in a circulating air furnace. A salt bath, by giving faster heat transfer, requires about 25 to 50% less total time than either air or muffle furnaces.

Any available furnace which provides temperature control to ± 10 F is suitable for aging beryllium copper. If temperature variations exist within the furnace, variations in hardness response can be expected. The thermocouple should be located so readings will be representative of the charge. Controlled or bright atmospheres are generally not necessary, as the discoloration caused by heating in air does not affect mechanical properties.

Salt baths, through rapid and uniform heating, offer special advantages for short-time, high-temperature and fixture hardening. Commercial salts melting at 275 to 290 F, consisting of sodium and potassium nitrate and nitrate mixtures, are generally used. After removal from the bath, parts should be carefully cleaned: quench in cold water, wash in



Retaining rings are typical of parts blanked from beryllium-copper strip in a two-die setup

hot cleaning solution, rinse in hot water, and dry. The chocolate-colored film that remains is in no way detrimental to the properties of the material and, where necessary for apperance, can be readily removed from the metal.

For solution annealing, any type of furnace offering suitable control up to 1475 F is satisfactory. In addition, some provision must be made to insure rapid quenching in water. Because most salts attack the surface of beryllium copper rather rapidly at this temperature, salt baths should not be used for annealing this material.

OTHER PROCESSING OPERATIONS

In addition to pressworking and heat treating, other operations may be necessary in fabricating components from beryllium-copper strip. These include joining, mechanical and chemical cleaning, plating, and coloring.

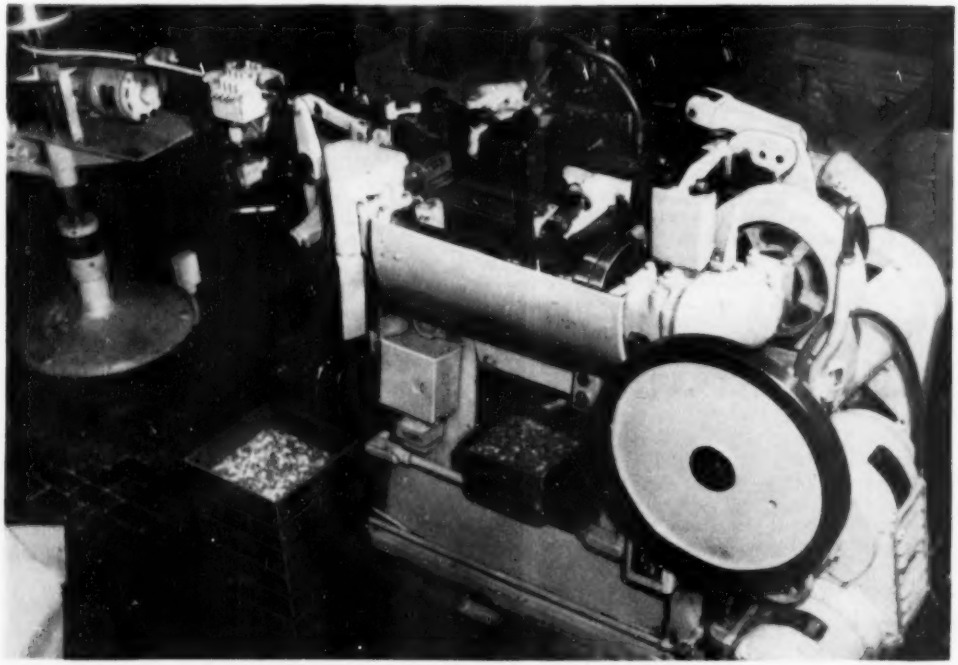
Joining

Although beryllium copper can be satisfactorily joined by carbon-, metal-, or inert-arc welding; soft soldering, silver brazing, and resistance welding are most commonly applied to strip fabrication.

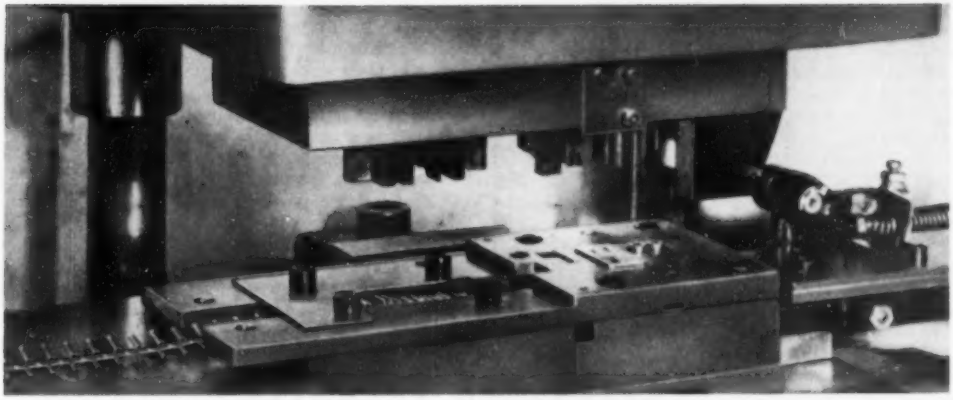
Soft soldering is recommended where strength is either not a factor or is provided by mechanical means, with the solder serving principally as a sealing medium. As working temperatures are low, soldering can follow heat treating without affecting final properties. Tin-lead (50 Sn - 50 Pb) solder can be depended upon to give good results with a soldering iron, gas-air torch, or oxyacetylene torch.

When parts can be cleaned following soldering, zinc chloride or other active fluxes, can be employed. Surfaces inaccessible for subsequent cleaning are frequently pretinned by hot dipping, plating, iron, or torch techniques to insure sound joints. Once tinned, components can be subsequently joined with a noncorrosive rosin flux.

Because of the higher temperatures involved, silver brazing should precede precipitation hardening. Beryllium copper softened during brazing can be heat treated to approximately peak properties.



Multi-slide machine uses six slides to form terminal springs in a nine-station progressive die at a rate of 180 pieces per min. Substantial investment in machines and tooling is justified by the volume required



Fully-automatic progressive die used for stamping beryllium copper radio tube socket terminals

Compared to soft soldering, silver brazing provides higher strength and superior resistance to corrosion and moderate temperatures.

Two silver brazing methods are commonly used:

1) Torch brazing with a solder that flows at 1145 F, confining heat to joint area. Work is then either air cooled or quenched, followed by aging at 600 F.
2) Employing a brazing alloy that melts at 1435 F, parts are heated to 1450 F, cooled to 1400 F to solidify the silver solder, and then the assembly is quenched in water. Aging at 600 F follows quenching.

The first, or low-temperature, procedure is easy to control and gives good results if heating times are short, while the second, or high-temperature, method is for furnace brazing or other long-cycle work. Entrapped flux, poor surface condition, or incomplete solder penetration are the chief causes of joint failure, and can be prevented by paying proper attention to the job.

Similar in weldability to cartridge brass or phosphor bronze, beryllium copper can be resistance welded to other beryllium copper parts or dissimilar materials by spot or seam methods. Spot welding provides a simple method for attaching contacts to beryllium copper flat springs.

The detrimental effects of high electrical and thermal conductivity upon weldability can be reduced through high welding current and short weld time. Current requirements exceed those for mild steel; so welders of low capacity may give trouble. Electronic synchronous timing units are recommended to maintain close control over the short weld-time periods. Similarly, pressure is critical and must be carefully controlled.

Water-cooled dome electrodes (RWMA Class 2) provide needed conductivity, offer advantages in aligning and cleaning, and are less likely to stick. In handling dissimilar metals, it may be necessary to use electrodes of different contour or conductivity to compensate for electrical and thermal conductivity variations.

Although beryllium copper can be resistance welded in any condition, unhardened material generally gives better results because of reduced conductivity. Resistance welding produces a heat-affected zone adjacent to the weld; however, part of the original strength can be restored through heat treatment.

MECHANICAL AND CHEMICAL CLEANING

In general, cleaning, buffing, and polishing procedures for beryllium-copper components follow usual copper alloy practice. Burrs can be removed from small parts by barrel tumbling, with time dependent upon the edge required. Solvent cleaning can be employed to remove lubricants, such as sulfurized mineral lard oils.

Either vaporized solvents (trichlorethylene) or alkaline cleaning solutions (various combinations of sodium carbonate, trisodium phosphate and sodium metasilicate) are satisfactory for the removal of oil, grease, or dirt. There are also available several proprietary electrolytic cleaning methods which leave a bright and clean surface, free from dirt and scale.

Tarnish, resulting from humid or sulfur-bearing atmospheres, can be removed from oil-free parts by a short immersion in either 10% sodium cyanide or 5 to 10% sulfuric acid solutions at room temperatures. Pieces should be thoroughly rinsed in water

following either cyanide or acid baths, and extreme caution should be observed in handling sodium cyanide, because this solution is a deadly poison.

Pickling is generally necessary to remove scale resulting from solution annealing or precipitation hardening, to meet appearance, joining, plating, or pressworking requirements. For best results, oil and grease should be completely removed prior to pickling, while pickling baths must be free from such contaminants as scraps of iron or steel. Tanks should be either ceramic or lead-lined.

Recommended pickling procedures are:

1. Immerse in a 20 to 30% by volume solution of sulfuric acid and water at 170 F long enough to completely loosen dark scale.
2. Rinse thoroughly in cold water after acid dip.
3. Dip briefly in a 30% by volume cold solution of nitric acid and water to remove all traces of black scale and red stains. Immersion time, which is limited to prevent etching the base metal, is best determined by trial.
4. Rinse thoroughly in cold water.
5. Immerse in a hot rinse, then dry by air blast, sawdust, or other available means.

Acid stains may result unless parts are carefully cleansed of all acid. Thorough washing in cold water, followed by hot rinsing, are necessary to remove all traces of acid. An acid-neutralizing dip is sometimes desirable between final cold and hot water rinses, to avoid any possible acid stain.

PLATING AND COLORING

BERYLLIUM-copper components may be plated for appearance, added protection, die lubrication, and electrical properties, with the following metals: cadmium, zinc, tin, copper, chromium, nickel, silver, rhodium, and gold. Some caution should be observed, however, in coating critical elastic elements, such as springs and diaphragms, because plating introduces excessive anelastic behavior, as measured by drift and hysteresis. On the other hand, plating baths do not cause hydrogen embrittlement in beryllium copper, so endurance will not be adversely influenced.

Where service requirements demand a white surface, either nickel or tin plating may be applied. Although tin remains white longer in mildly corrosive atmospheres, and provides sacrificial protection under severely adverse conditions, the final selection between these metals will depend upon economy and the corrodants present.

A tin base is of advantage in soft soldering, as it permits the use of non-corrosive rosin fluxes. Parts can be tinned by hot-dipping in conjunction with a chloride flux to give coatings roughly 0.0008 in. thick, while electroplating can be employed to deposit coatings meeting the minimum thickness requirement for soldering of 0.0003 to 0.0005 in.

Tin, zinc, and cadmium coatings may be used to compensate for differences in electrochemical potential at bimetallic junctions. In addition, cadmium plate 0.0001 to 0.0003 in. thick is frequently used as a die lubricant in pressworking to enhance punch and die life. For resistance to corrosion from phenolic or vinyl plastics of rubber, beryllium-copper molds are usually given a hard chromium plate, 0.003 to 0.006 in. thick.

Plating Procedures

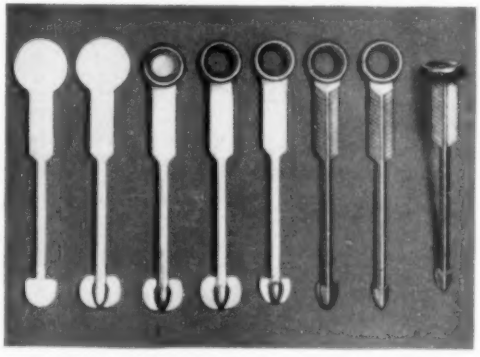
Cadmium plating may be applied by the following cyanide bath with optional organic or inorganic addition agents as brighteners:

Cadmium oxide (CdO)	– 6 oz/gal
Sodium cyanide (NaCN)	– 16 oz/gal
Temperature	– 70 to 95 F
Current density	– 10 to 30 amp/sq ft

Copper plating can be handled by either acid or Rochelle-salt cyanide baths:

Copper sulfate ($CuSO_4 \cdot 5H_2O$)	– 33 oz/gal
Sulfuric acid (H_2SO_4	– 8 oz/gal
Temperature	– 75 to 120 F
Current density	– 15 to 30 amp/sq ft
(or)	
Cuprous cyanide (CuCN)	– 6 oz/gal
Total sodium cyanide (NaCN)	– 7.5 oz/gal
Free cyanide (NaCN)	– 0.75 oz/gal
Rochelle salt ($NaKC_4H_4O_6 \cdot 5H_2O$)	– 6 oz/gal
Sodium carbonate (Na_2CO_3	– 4 oz/gal
Temperature	– 120 to 140 F
Current density	– 20 to 30 amp/sq ft

Tin plating should be carried out in an alkaline



Successive blanking, piercing, drawing, and bending operations are required in the production of fountain pen pocket clips. Such parts are usually finished by gold or rhodium plating

sodium-stannate bath when facilities permit operation at 150 F, otherwise the acid stannous-sulfate bath can be used at room temperature.

Sodium stannate (Na_2SnO_3)	– 12 oz/gal
Sodium hydroxide (NaOH)	– 1 oz/gal
Sodium acetate ($NaC_2H_3O_2$)	– 2 oz/gal
Hydrogen peroxide (H_2O_2)	– 0.3 oz/gal
Temperature	– 130 to 160 F
Current density	– 20 to 60 amp/sq ft

(or)

Stannous sulfate	– 9 oz/gal
Cresolsulfonic acid	– 16 oz/gal
Free sulfuric acid	– 9.5 oz/gal
Gelatin	– 0.33 oz/gal
Beta Napthol	– 0.17 oz/gal
Temperature	– 70 to 95 F
Current density	– 10 amp/sq ft

Chromium plating of the hard or industrial type, as distinguished from ornamental work, can be deposited as follows:

Chromic acid (CrO_3)	– 30 to 50 oz/gal
Sulfuric acid (H_2SO_4)	– 0.3 to 0.5 oz/gal
Temperature	– 100 to 160 F
Current density	– 150 to 300 amp/sq ft

Nickel plating can be applied by several normal or bright methods.

(normal)

Nickel sulfate ($NiSO_4.7H_2O$)	– 16 oz/gal
Ammonium chloride (NH_4Cl)	– 2 oz/gal
Boric acid (H_3BO_3)	– 2 oz/gal
pH	– 5.3
Temperature	– 70 to 90 F
Current density	– 10 to 20 amp/sq ft

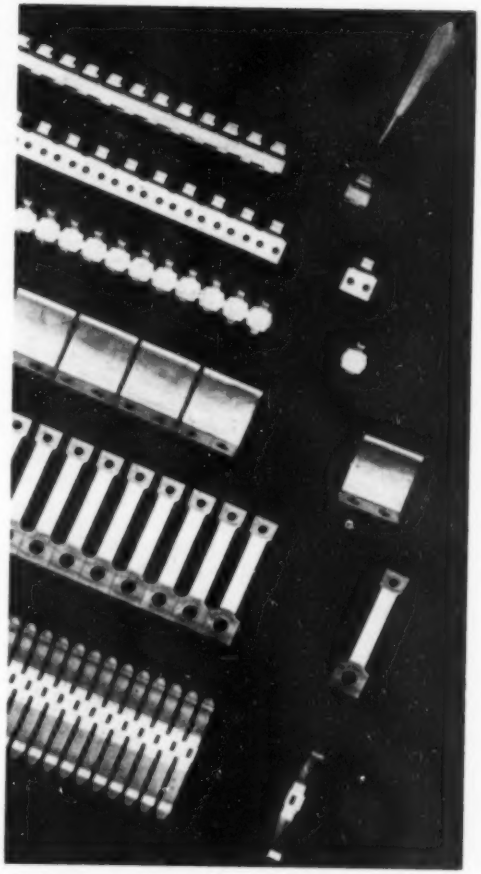
(used with organic brighteners)

Nickel sulfate ($NiSO_4.7H_2O$)	– 30 to 40 oz/gal
Nickel chlordie ($NiCl_2.6H_2O$)	– 6 oz/gal
Boric acid (H_3BO_3)	– 4 oz/gal
pH	– 2.0 to 5.2
Temperature	– 100 to 150 F
Current density	– 25 to 50 amp/sq ft

Zinc plating can be handled in a cyanide bath with or without brighteners.

Zinc cyanide ($Zn(CN)_2$)	– 8 oz/gal
Sodium cyanide (NaCN)	– 3 oz/gal
Sodium hydroxide (NaOH)	– 7 oz/gal
Temperature	– 70 to 95 F
Current density	– 10 to 30 amp/sq ft

Silver plating is done by using two baths, a strike bath followed by the regular plating solution. Thicknesses of silver plating usually range from 0.0002 to 0.0004 in., with heavier plates sometimes necessary for special work. Silver coatings (0.0005 to 0.005 in. thick) frequently serve as an underlay for gold or rhodium plating.



Fixture-hardened flat springs are produced in strips and scored so they can be easily broken apart by hand or by automatic assembling devices

(strike)

Silver cyanide	– 0.62 troy oz/gal
(Metallic silver equivalent to above)	– 0.5 troy oz/gal
Free sodium cyanide	– 10 avdp oz/gal
Temperature	– 72 to 86 F
Current density	– 15 to 25 amp/sq ft
Voltage	– 6 v

(regular)

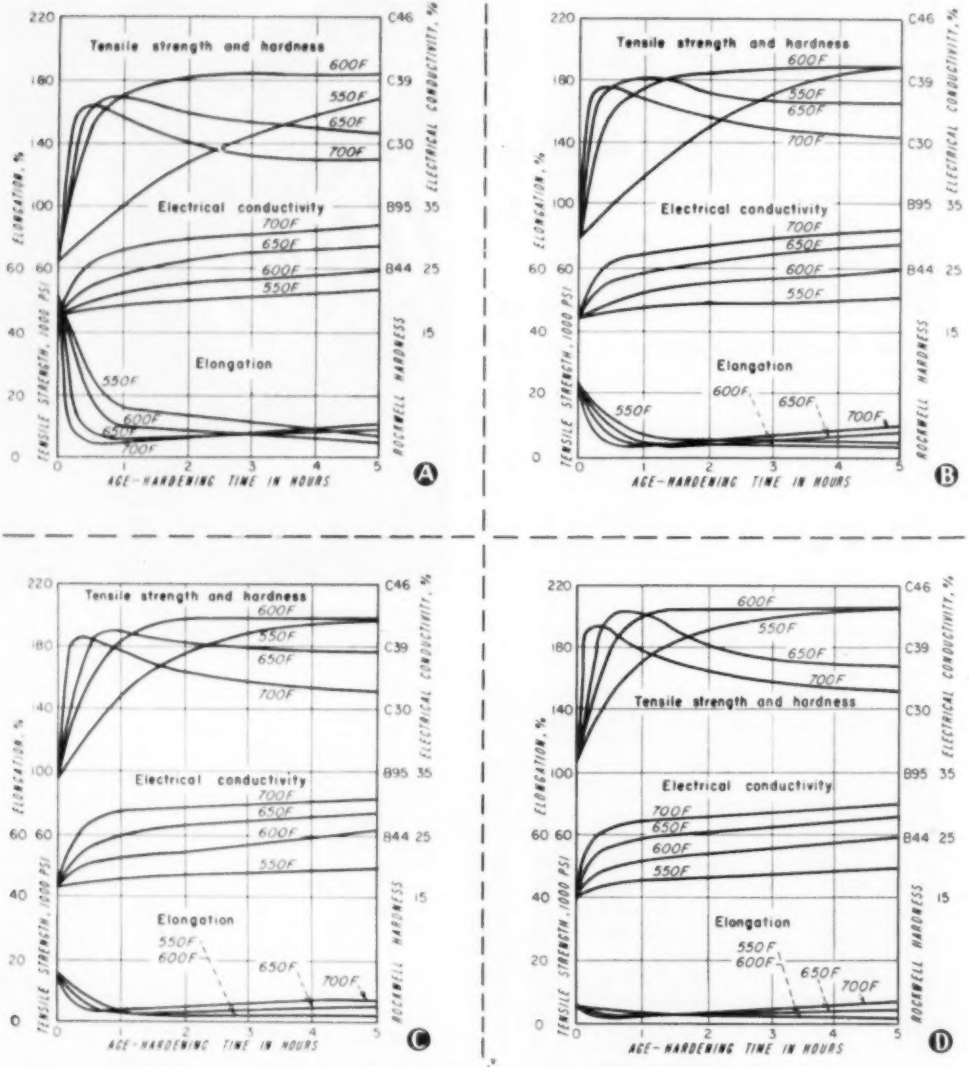
Silver cyanide	– 3.7 troy oz /gal
(Metallic silver equivalent to above)	– 3.0 troy oz/gal
Potassium cyanide	– 5.5 avdp oz/gal
Potassium carbonate	– 6.0 avdp oz/gal
Temperature	– 72 to 86 F

Current density	– 5 to 20 amp/sq ft
Voltage	– 1 v

Gold plating can be applied directly from a gold cyanide bath, or over a silver, copper, or nickel undercoat using anodes of 24-carat gold. Thicknesses of 0.0001 to 0.0002 in. are generally suitable for contact and similar applications.

Gold cyanide (AuCN)	– 1.5 oz/gal
Soduim cyanide (NaCN)	– 2.25 oz/gal
Temperature	– 130 to 140 F
Current density	– 5 to 15 amp/sq ft

Rhodium plating is employed to provide special surfaces and can be plated directly over silver from proprietary rhodium solutions. A rhodium thickness of 0.0001 to 0.0002 in. is satisfactory for most contact applications. Where severe mechanical wear exists, plates may be run up to 0.001 in.



Influence of heat-treat time and temperature on tensile strength, hardness, elongation, and electrical conductivity are indicated by these charts for (*A*) solution-annealed, (*B*) quarter-hard cold-rolled, (*C*) half-hard cold-rolled, and (*D*) cold-rolled hard beryllium copper

Table IV — BERYLLIUM COPPER MEETS THE FOLLOWING CURRENT SPECIFICATIONS

AUTHORITY	SPECIFICATIONS	FORMS COVERED	TEMPERS COVERED
American Society for Testing Materials	B194	Strip	All
	B196	Rod & Bar	All
	B197	Wire	All
Society of Automotive Engineers (Aircraft Material Specifications)	AMS 4530	Strip	Solution Treated
	AMS 4532	Strip	Half-Hard
	AMS 4650	Rod, Bar & Forgings	Solution Treated
	AMS 4725	Wire	Solution Treated
Military	MIL-C-947 (Ships)	Strip, Rod, Bar & Wire	All
	MIL-C-6941	Rod, Bar & Wire	All
	MIL-C-6942	Strip	All

Note: Revision letters and date suffixes, which frequently change, are not listed.

Table V — TEMPER SELECTION FOR BERYLLIUM-COPPER STRIP

TEMPER	COLD ROLLED REDUCTION IN B&S NUMBERS	ASTM DESIGNATION	% REDUCTION IN THICKNESS	RELATIVE FORMABILITY
Solution Annealed	0	A	0	Best for deep-drawn, cupped or severely formed parts
¼ Hard	1 No. Hard	¼ H	11	Almost as formable as solution-annealed stock and gives better spring properties
½ Hard	2 No. Hard	½ H	21	Moderate formability with good strength for parts incorporating liberal radii or light drawing
Hard	4 No. Hard	H	37	Max. mechanical properties with reduced cold-forming characteristics for parts essentially flat

Typical sulfate and phosphate baths are:

Sulfuric acid	– 20 ml
Proprietary rhodium solutions	– 2 g
Water	– 1000 ml
Temperature	– 100 to 110 F
Current density	– 10 amp/sq ft
Voltage	– 2.5 to 5 v

(or)

Phosphoric acid	– 10 to 40 ml
Proprietary rhodium solutions	– 2 to 4 g
Water	– 1000 ml
Temperature	– 100 to 110 F
Current density	– 10 amp/sq ft
Voltage	– 2.5 to 5 v

To meet certain service requirements, it may occasionally be necessary to color beryllium copper components. Standard coloring procedures for handling copper or high-copper alloys can be depended upon to give good results, while proprietary processes are also available. Immersion in a given solution may produce one or more colors, so the part should be held in the bath for a given length of time until the desired tone is obtained.

Because the surface condition of material entering the plating bath exerts the greatest influence on the final result, it is essential that parts be absolutely clean and free from oxide, oil, grease, and dirt. Where chromic acid or dichromate pickling solutions may have preceded plating, it is necessary to remove the thin oxide film by a cold 30% nitric acid bath prior to plating, to insure good adherence of the plate.

Recommendations for cleaning, pickling, and degreasing have been given above, and these should be followed to obtain the best plating results.

Because beryllium copper is relatively expensive, as compared to most other copper alloys, it is important to avoid scrap in plating, usually the final operation. Attention should be paid to maintaining correct temperatures and current densities, and to insuring good electrical contact between the work and the racks.

In general, standard electroplating practices should be followed, as for plating brass and other copper alloys. Usually, however, plating on beryllium copper serves a functional, rather than a decorative purpose, so its adhesion is of greater importance because failure may result in malfunction of some major mechanism into which the part has been incorporated. Proper attention to cleanliness will usually insure satisfactory results.

Table VI—TYPICAL MECHANICAL PROPERTIES OF HEAT-TREATED BERYLLIUM-COPPER STRIP

	HEAT-TREATED FROM			
	SOLUTION ANNEALED AT	QUARTER HARD ¼ HT	HALF HARD ½ HT	HARD HT
Tensile Strength, psi	165-195,000	175-200,000	185-210,000	190-215,000
Proportional Limit (0.002% Offset), psi	100-125,000	110-135,000	120-145,000	125-155,000
Yield Strength (0.01 % Offset), psi	110-135,000	120-145,000	130-155,000	135-165,000
Yield Strength (0.2 % Offset), psi	140-170,000	150-180,000	160-190,000	165-195,000
Yield Strength (0.5% Extension), psi	90-100,000	90-100,000	90-100,000	90-100,000
Tension Modulus, psi	19,000,000	19,000,000	19,000,000	19,000,000
Elongation, %	5-10	3-7	2-5	1-4
Rockwell Hardness				
Strip 0.032 in. thick and over (B Scale)	36-42	38-43	39-44	40-45
Strip 0.015 in. thick and over (30 T Scale)	56-62	58-63	59-64	60-65

Table VII—TYPICAL MECHANICAL PROPERTIES OF HEAT-TREATABLE BERYLLIUM-COPPER STRIP AS SUPPLIED

	SOLUTION ANNEALED A	QUARTER HARD ¼ H	HALF HARD ½ H	HARD H
Tensile Strength, psi	60-78,000	75-88,000	85-100,000	100-120,000
Proportional Limit (0.002% Offset) psi	15-20,000	40-60,000	55- 70,000	70- 85,000
Yield Strength (0.01% Offset), psi	19-30,000	47-67,000	64- 76,000	82- 99,000
Yield Strength (0.2% Offset), psi	28-36,000	60-80,000	75- 90,000	100-112,000
Yield Strength (0.5% Extension), psi	30-37,000	63-79,000	75- 90,000	90-102,000
Tension, Modulus, psi	17,000,000	17,000,000	17,000,000	17,000,000
Elongation, %	35-60	10-30	5-15	2-7
Rockwell Hardness				
Strip 0.032 in. thick and over (B Scale)	45-78	68-90	88-96	96-102
Strip 0.015 in. thick and over (30 T Scale)	46-67	62-75	74-79	79-83

ENGINEERING PROPERTIES OF STRIP

APPLICABLE Government and technical-society specifications for beryllium-copper strip, and data on the relative formability of different tempers are given in accompanying tables. More specific information on bending, forming, drawing, and workhardening have been given in preceding tables.

The more important physical characteristics are given in another table, and it will be noted that both electrical and thermal conductivity increase substantially during precipitation hardening. Electrical conductivity also improves with increasing heat-treating time and temperature. Typical mechanical properties for heat-treatable tempers and heat-treated strip are also shown in accompanying tables.

When service temperatures exceed 300 F, relaxation may occur in spring members, so some allowance may be necessary in design stresses. On the other hand, beryllium copper offers increased elastic properties in subzero atmospheres with no loss of shock resistance. This property makes it particularly useful for applications in arctic and high-altitude aircraft work.

Corrosion Resistance

Like other high-copper alloys or deoxidized copper, beryllium copper provides good resistance to fresh or salt water, marine atmospheres, many alkaline solutions, and some acids. Dezincification, hydrogen embrittlement, and season cracking apparently do not occur; however, poor resistance is offered to certain compounds of ammonia, mercury, and sulfur. Combinations of corrosion and alternating stress (corrosion fatigue) have no effect upon normal endurance properties unless beryllium-copper is subject to direct chemical attack in an unstressed condition by the corrosive.

Table VIII — TYPICAL PHYSICAL PROPERTIES OF HEAT-TREATED BERYLLIUM-COPPER STRIP

Specific Gravity	8.30
Density, lb/cu in.	0.300
Magnetic Properties	Non-magnetic
Melting Range, °F.	1600 to 1800
Increase in Density on Heat Treatment, %	0.6
Decrease in Length on Heat Treatment, %	0.2
Specific Heat, cal./g./°C.	0.10
Thermal Expansion Coefficient,	
Per °C. (20 to 100 C.)	0.0000167
(20 to 200 C.)	0.0000170
(20 to 300 C.)	0.0000178
Per °F. (68 to 212 F.)	0.0000093
(68 to 393 F.)	0.0000094
(68 to 572 F.)	0.0000099
Poisson's Ratio	0.35
Elastic Modulus, psi (68 F.)	19,000,000
Elastic Modulus Temperature Coefficient, % Change/°F.	0.02
Electrical Conductivity, % IACS (20 C.)	22 to 30
Electrical Resistivity, microhm cm (20 C.)	7.8 to 5.7
(200 C.)	9.4 to 6.8
Temperature Coefficient of Resistivity (20 to 200 C.)	0.0009
Thermal Conductivity,	
Btu/sq ft/in./hr/°F (68 F.)	750 to 900
(392 F.)	900 to 1100
Cal./sq cm/cm/sec/°C (20 C.)	0.26 to 0.31
(200 C.)	0.32 to 0.37
Temperature Coefficient (20 to 200 C.)	0.0012

DESIGN CONSIDERATIONS

RECOMMENDATIONS for designing beryllium-copper stampings are given in Table IX. In most instances, optimum conditions are obtained only through increased tooling and production costs.

In analyzing a fabricating problem at the design stage, some consideration must be given to assembly, repair, and replacement costs, as well as those incurred by tooling and production. For example, the designer must determine whether the added expense of fixture hardening will offer over-all economies through decreased assembly or service charges.

In further considering fixture hardening, it should be remembered that care must be exercised during blanking because burrs reduce the accuracy attainable. On the other hand, springback need not be closely controlled in bending, so tooling costs can be reduced. By utilizing part of the assembly for a fixture where possible, additional savings can be effected.

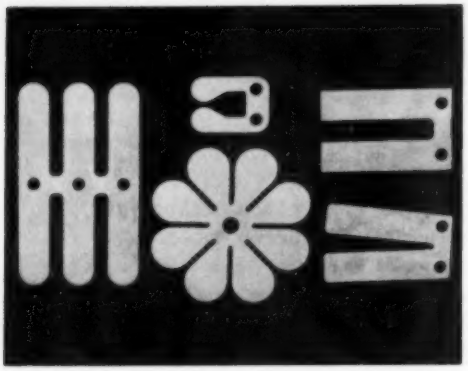
In designing flat springs and similar components, some allowance must be made for forms that introduce higher stresses than indicated by formula. High localized stresses can be caused by bends, holes, and uneven clamping surfaces. Contacts, affixed either by rivets or resistance welding, should be located at points of low stress concentration, otherwise pre-

Table IX — DESIGN RECOMMENDATIONS FOR BERYLLIUM-COPPER FLAT SPRINGS

	Recommended or Standard	Optimum or Extreme
Minimum hole diameter (t = stock thickness)	2 t and at least 0.040 in.	t and at least 0.025 in.
Hole diameter tolerances,		
up to ½ in.	± 0.003 in.	± 0.0002 in.
½ to 1 in.	± 0.005 in.	± 0.005 in.
1 to 2 in.	± 0.010 in.	± 0.001 in.
Minimum wall between edge and hole	4 t	2 t
Hole center distance tolerances in same plane,		
up to 1 in.	± 0.005 in.	± 0.001 in.
1 to 2 in.	± 0.005 in.	± 0.002 in.
2 to 4 in.	± 0.010 in.	± 0.002 in.
Hole center to edge tolerances	± 0.010 in.	± 0.001 in.
Width or length tolerances in same plane,		
Up to 1 in.	± 0.007 in.	± 0.001 in.
1 to 2 in.	± 0.010 in.	± 0.001 in.
2 to 4 in.	± 0.015 in.	± 0.001 in.
Minimum slot width	4 t and at least 0.040 in.	2 t and at least 0.010 in.
Slot width tolerances	± 0.005 in.	± 0.001 in.
Minimum finger width	4 t and at least 0.040 in.	2 t and at least 0.010 in.
Finger width tolerances	± 0.010 in.	± 0.002 in.
Minimum bend radius	See Table I.	
Flatness within:		
L = ½ in. max.	0.005 in.	0.001 in.
L = 1 in. max.	0.010 in.	0.002 in.
L = 2 in. max.	0.025 in.	0.005 in.
L = 3 in. max.	0.040 in.	0.010 in.
Angular tolerances	± 2–5°	± ½–2°
Offset tolerances	± 0.010	± 0.001 in.
Maximum die burr, t = 0.002 to 0.0045 in.	6 t	0
t = 0.005 in. and over	5 t or 0.005 in. max.	0

(Courtesy Instrument Specialties Co., Inc.)

Note: These recommendations are general and exceptions are possible.



Engine and compressor flap valves are made from beryllium copper to provide needed flatness and corrosion resistance. Considerable care must be taken in blanking to avoid burrs and sharp edges

mature failure may occur. In general, a design formula should be used only as a guide, to be supplemented by actual tests.

The engineering properties of beryllium copper shown herein result from tests conducted under inspection or laboratory procedures, so some care should be exercised in attempting to incorporate these values in design work. Safe working stresses depend not only on the material used, but also on type of load (static or endurance) and operating condition.

In addition, design stresses derived from engineering properties should be used only where the part can be readily subjected to stress analysis.

For static loads, the stress will be limited by the amount of offset or permanent set permissible in the application—never by the ultimate strength. When no regularly measurable deviation from the elastic condition is allowable, working stresses must be kept below the proportional limit. When space permits, a maximum design stress of at least 10,000 psi below the proportional limit is recommended to insure positive action in statically loaded parts.

Though frequently employed for copper alloys, the yield strength at 0.5% extension under load has limited value as an index of plastic damage. As indicated in Table VI, the proportional limit always exceeds this yield value for heat-treated strip, so the specified extension can be produced elastically, and the yield value is dependent solely on the tension modulus. Even in the case of unhardened strip, the hard temper has a proportional limit greater than the yield strength at 0.5% extension. Consequently, yield strengths qualified by 0.01% or 0.2% offset may prove more useful for design purposes.

In the case of endurance loads, however, it is necessary to reduce design stresses to prevent failure from fatigue. For best results, a factor of safety should be applied to the endurance values listed to allow for corrosion, changes in section, elevated temperatures and other variables. Even when working stresses are within prescribed limits and ample allowance has been made for yield or fatigue, small deviations from elastic laws can be observed. An elasticity (hysteresis, damping, creep, and drift) is greatly influenced by stress and temperature, so some allowance may be necessary in critical uses.

Contrary to widespread belief, experience shows that relatively high strength in the fully heat-treated condition does not indicate brittleness or loss of fatigue resistance. Failure on the part of strip of a given temper to precipitation-harden to a certain level may be an indication of inferior structure. Such material frequently offers decreased resistance to shock and fatigue.

It is generally advantageous for a spring material to have a relatively high proportional limit. To produce a high proportional limit, it is generally necessary to sacrifice some ductility. In most spring applications, however, ductility does not prevent failure from overstressing, and a decreased proportional limit will cause inelasticity or excessive set at lower stress levels.

For applications requiring added ductility in the hardened condition, to permit forming during assembly or in the field, it is frequently advisable for the user to select a suitable under- or over-aging treatment. For certain design situations, some ductility may be needed to prevent impact failure or to permit partial relief of localized stress concentrations through plastic yielding. In the more usual case, where beryllium copper is completely formed in the hardened condition, it is advantageous to heat treat for maximum spring properties.

Formability Limitations

Some caution should be observed in attempting to predict formability from elongation, as both strip thickness and gage length have considerable bearing on elongation value. Even for a given gage length and thickness, beryllium-copper strip in the harder tempers has higher elongation in the transverse direction but, as indicated in Table I, has decreased formability across the strip.

In using beryllium copper in place of some other material, it is generally not advisable to make a direct substitution. To utilize fully the properties available in beryllium copper, parts should be redesigned to allow for changes in modulus, allowable stress, and conductivity.

ACKNOWLEDGMENT

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Waldes-Kohinoor, Inc.

Where you will find THE REAL REVOLUTION

"If we keep in mind the values of opportunity, competition, democracy, productivity, then it is our capitalist society which is the truly revolutionary one – the only society which offers true hope to the masses for release from the long nightmares of tyranny. It is we, not the Marxists with their reactionary ideas of the good dictator, who have the truly constructive, the truly revolutionary ideal."

– from "Capitalism" by David McCord Wright.

If we can only win recognition of this truth, we shall win the struggle of free men against communism. This editorial discusses some of the hurdles that must be cleared.

To win the needed recognition that "our capitalistic society... is the truly revolutionary one," we must keep pounding away both abroad and at home. That is because the communists simultaneously attack us on an international front and try to undermine us from within.

The present drive to rearm ourselves and our allies is crucial to our self-protection on the international front. We must be prepared to meet the armed force of aggressive communism with armed force if we are to secure our physical freedom.

Arms are not enough

But to re-establish parity in arms is only half of the battle. In the last analysis it is not the more important half. To be effective, our arms must be backed by loyalty of men to our ideals. So, both abroad and at home, we must win men to the faith that we do have "the truly constructive, the truly revolutionary ideal."

On the international front, the effort to win adherence to such faith in our capitalist society meets tough going. That arises from the fact that in some of the countries that are allied with us in the fight against communism, capitalist society has offered to its people no such ideal. In varying degrees "the values of opportunity, competition, democracy, productivity" – those key aspects of American capitalism – are either absent or subordinated in their economic life. Indeed, the *Wall Street Journal* recently remarked that "to the European, capitalism has become synonymous with cartels – and with the disregard cartels foster for the consumer, the worker and the over-all well-being of the nation's economy."

No Simple Solution

Nonetheless, many European labor and governmental leaders sincerely believe that cartels are essential to their economic salvation. They believe that without such restrictions in congested European markets there would be intolerable cut-throat competition and instability of employment. Thus, when we point out that the cartel capitalism so prevalent in Europe lacks the constructive qualities of competitive American capitalism, we may offend European leaders whose wholehearted cooperation we need in the fight against communism.

But, if we soft-pedal that contrast, we sacrifice the opportunity to win understanding and loyalty from millions of Europeans who have had no chance to learn that capitalism can be the constructive and liberalizing force that it is in the United States. Indeed, when many of these millions embrace socialism it is not because they love it. They are rather desperately seeking a tolerable middle course between what they consider the hateful extremes of communism and the undesirable aspects of capitalism as they understand it.

New name not the answer

We know that there is no easy way to handle the problems created by such misunderstanding of American capitalism. Neither do we share the belief that much of the difficulty would be overcome if we were to call American capitalism by some other name. By doing that, the argument runs, we shall relieve it from the unpleasant connotations that are attached to the word capitalism in some other parts of the world. But, after all, if we are to give up all the terms that have come to mean something else in other parts of the world, we must begin by ditching the term "democracy" which, in the official jargon of the Kremlin, seems to mean what we call dictatorship.

In spite of the difficulties, however, we must stick to this job of exporting the truth that our capitalist system does offer opportunity, competition and democracy. We must let the rest of the world see that it means a continuous drive for increased productivity, and the search for profits by increasing sales and consumption, not by trying to sell less for more.

Export alone not enough

The spreading of truth about American capitalism will not be effective if it is merely directed abroad. Unless it is carried on at home also, it will lack the driving faith that is essential to any convincing export of this type. Nor will export alone come to grips with the communist attack on our country from within—an attack that gets too much help from loyal Americans who short-sightedly repudiate the basic principles of our institutions in their efforts to reform some of their deficiencies. For success both at home and abroad, we must have right here at home a much more militant recognition that it is in fact our capitalist society which offers "the truly constructive, the truly revolutionary ideal."

Here at home, too, this raises difficult complications. Businessmen who are among the leaders and principal practitioners of capitalism, have generally been catalogued as conservatives. Hence, many people must stretch their imaginations a bit to see that businessmen are leaders of a development which has so greatly and so rapidly improved the lot of free men in America that it is truly revolutionary.

These difficulties of definition, however, are relatively superficial aspects of the problem of seeing our capitalist society clearly. The basic facts are that:

American capitalism is leading free men to an ever higher material standard of living while respecting their spiritual, social and political freedom.

Communism is leading its people back into a life of servile regimentation under dictatorship.

American capitalism advances to high ground never before attained by free men. Communism retreats to ground that men with an appetite for freedom throughout the ages have sought to escape. If we can establish this truth firmly, around the world, we shall no longer need to worry about communism. It will be hopelessly sunk.

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ROUND TABLE

Variety Shop

"Say, Ed, don't you think it'd be a good thing to standardize on your equipment?"

"Now what's coming out of that head of yours? I don't have any special machines around."

"But don't you think that it would be better to have one make of lathe throughout the shop instead of the variety you have?"

"What gives you that idea, Al? Sometimes a particular job can be done better on one type, sometimes on another."

"Well, it seems to me that the boys would turn out more work if they didn't have to switch around from one type of machine to another—you know, Ed, how it is to jump from one kind of car to another."

"Now listen here, my friend, this is a shop, not a parking lot."

"All very true, but I still think that a man who becomes accustomed to one make of lathe will be able to handle it with greater ease, and, as a consequence will turn out work in less time."

"Your idea is rather narrow, ain't it, Al? Has it ever occurred to you that a shop equipped with many kinds of machines is more adaptable to a variety of jobs—you take that shaper there; can you say that it is better or worse than the other machines? No, it has its place in the equipment lineup and earns its salt because it is adaptable to a certain type of work, while the other-make shaper back of it has a different range. We've got to have variety in the shop to handle the equal variety of work that comes through."

"Then again, there is the question of upkeep, Ed. One could provide repairs a lot easier if his equipment were standardized."

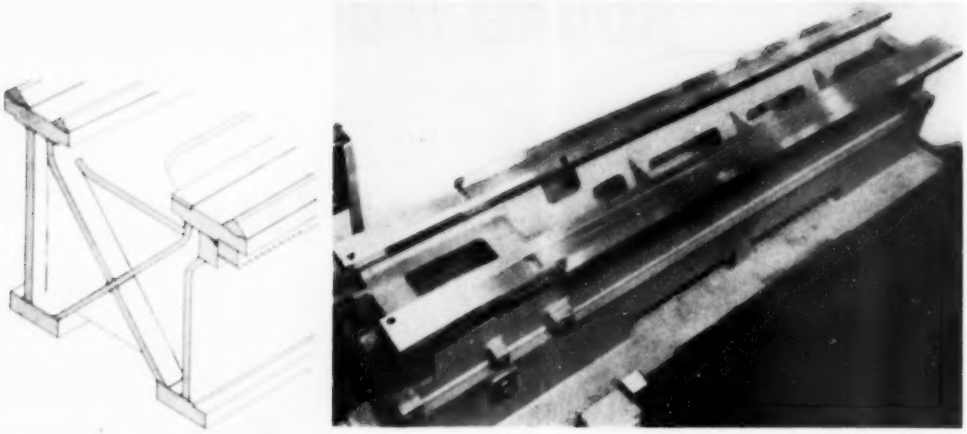
"Baloney! I've never had any trouble with securing repair parts for any of our machines. I'm really amazed at the speed with which we get parts—even with some of the old standbys."

"I'd like to have a test made on some of the machines to see which can turn out to the best advantage."

"That's like trying to tell which animal is the best in the jungle—they all have their little peculiarities."

"So have you, Ed . . ."

***WHICH IS** preferable, variety in makes, or standardization? What about versatility vs repairs? Should toolrooms and production shops have different customs on this question? Your ideas and opinions on this subject will interest others. Discussions of earlier topics appear on later pages.*



FABRICATED STEEL LATHE BED is a major feature of seagoing lathe that qualifies for Naval and Maritime service. Bed provides necessary rigidity to offset lack of stable foundations aboard ship. Construction is based on opposed, interlocking triangles. "I"-shaped front and back walls are connected to diagonal plates and are reinforced by vertical cross-plates. After welding and normalizing, bed is machined; hardened ways then are permanently attached

SEAGOING LATHE WEATHERS ALL BLOWS

How can a lathe be built to withstand the shocks, deflections, and strains of shipboard operation? Here are details on a welded-steel lathe bed, plus special machine supports developed by Reed-Prentice to solve the problem

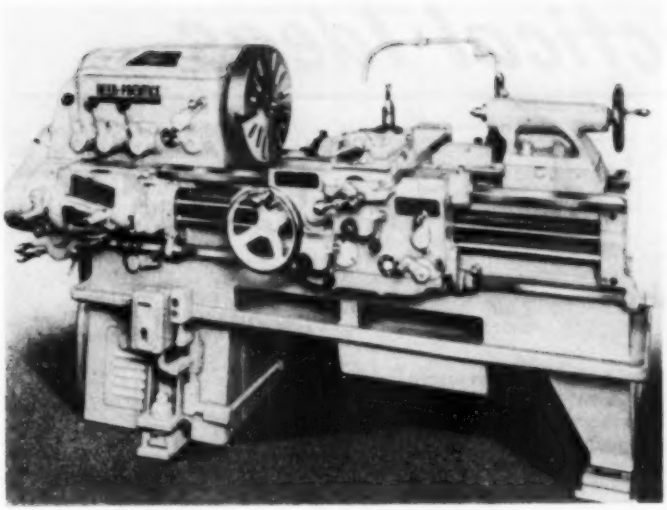
Precision machinery aboard ship differs from land installations because of the absence of stable foundations. Accuracy and reliability, however, are just as essential at sea as ashore. Compensation for the lack of stationary and level foundations, therefore, must be made.

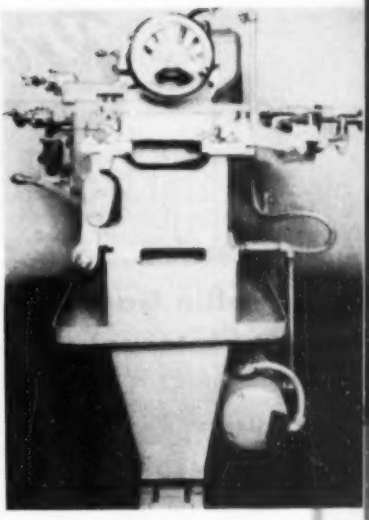
For lathes, perhaps the most important requirement is a rigid bed. Absolute rigidity is theoretical and unattainable, but a near approach is possible by making the bed of fabricated reinforced steel instead of conventional cast iron. The margin between such a bed and ultimate rigidity can be bridged by supporting the bed in a manner which absorbs or dissipates the forces that cause deflections and strains. The way in which this has been accomplished is shown in accompanying illustrations.

The fabricated steel bed exceeds the rigidity of cast iron several times. Its design is based on the triangle, the strongest and most rigid structural form attainable. The bed rests on a full-length base which, in turn, is supported by legs. This construction eliminates strains which would otherwise be transmitted to the bed. The base adds its strength to the bed, being in effect a supporting beam.

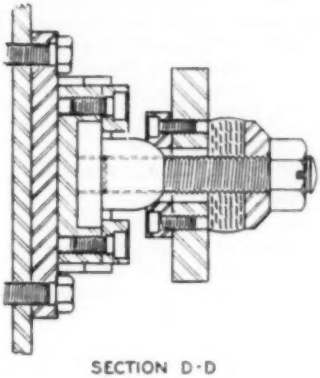
The welded steel legs rest on three cushioned ball-and-socket bearings secured to the ship's deck. These bearings have two functions in common: (a) to sustain weight of the lathe, (b) to anchor it in position regardless of whether the deck is plane or cambered. In addition, each has a third and individual function. The rear is a pivot, the front allows horizontal motion at right angles to work centers, and the tailstock end allows horizontal motion in all directions. These provisions effectively block transmission of strains to the bed caused by changing deck conditions that occur when a vessel is under way or is in heavy seas. Cushions in each of the three support bearings absorb shocks such as might be caused by gunfire.

After passing standard Naval inspection, the first lathe of this design was tested for output and accuracy. No foundation was prepared, no levelling attempted, and the machine was not anchored in place. Results were very satisfactory from the beginning.

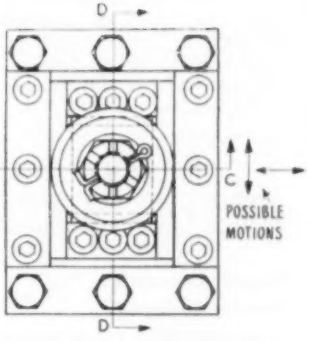




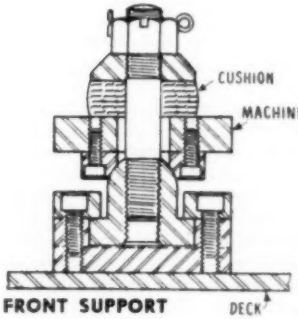
ARTICULATED SUPPORTS consist of three cushioned ball-and-socket bearings secured to ship's deck. Supports prevent transmission of strains to lathe bed. Rear support is a pivot; the front allows horizontal motion at right angles to work centers; the tailstock support allows horizontal motion in all directions. Cushions absorb shock



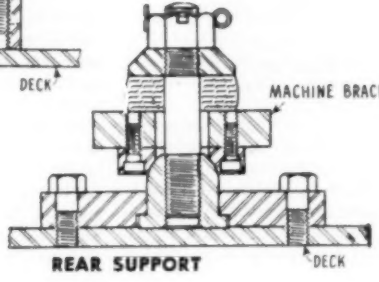
SECTION D-D



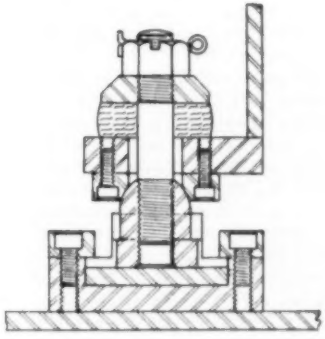
TAILSTOCK END SUPPORT



FRONT SUPPORT

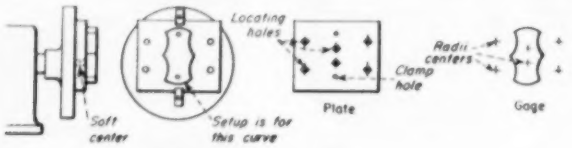


REAR SUPPORT



SECTION C-C

Practical Ideas



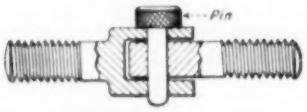
Profile Gages Finished On Internal Grinder

THIS UNIQUE FIXTURE enabled us to do forming work on an internal grinder when our surface grinders were tied up. The work consisted of surface gages with all edges to one radius or another.

First we jig-bored a plate to be clamped against the faceplate of the grinder. This had countersunk holes to take bolts that assembled the work to it, and also plain holes located exactly at the centers of the radii that had to be machined on the edges of the work.

A soft center was turned down to slip fit into the plain holes, and this was mounted in the grinder spindle nose. It projected past the faceplate just enough to nest in the plain holes in the jig-bored plate.

Thus, we could locate the plate and work on the faceplate, then clamp it so an exact radius would be ground by the quill. An experienced operator made the setup, but an apprentice was able to operate the machine after that. *T. J. Roberts, Waynesburgh, O.*



Simple Connection Powers Tailstock

A PIN AND YOKE, linked by a pin with a knurled head, permit operating the tailstock of a standard lathe under carriage power. This is often useful for drilling, tapping, and boring work.

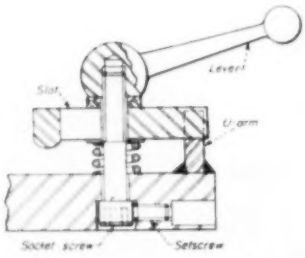
Holes are drilled and tapped horizontally in the carriage and tailstock castings. These should be low and back from the front of the lathe—as near to the lathe centerline as possible. The U-shaped yoke and drilled pin are inserted permanently, and therefore should be deep. If they extend too much, they will limit carriage travel toward the tailstock.

The connection can be made with the link pin whenever a powered tailstock is desired. Otherwise, the pin is not inserted. *J. Woerle, Augsburg, Germany.*

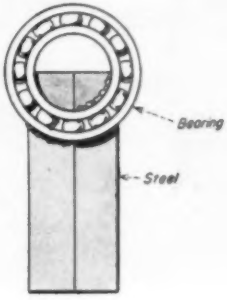
Swivelling Clamp Arm Has Fast Action

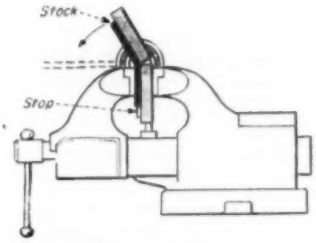
WITH A SETSCREW having coarse threads in this clamp fixture, action is rapid and more positive than a cam, and more convenient than a knurled handwheel. In addition, the toe can be quite short.

The ball-end arm bears in a



dished collar that forces the clamp arm down on the work, pivoting on a U-shaped bracket at the back of the base. Spring pressure raises the clamp when released. Socket-head-screw adjustment to permit different workpieces to be held is provided. The screw is locked by a small setscrew located in the base. *Edward Walker, Waukesha, Wis.*



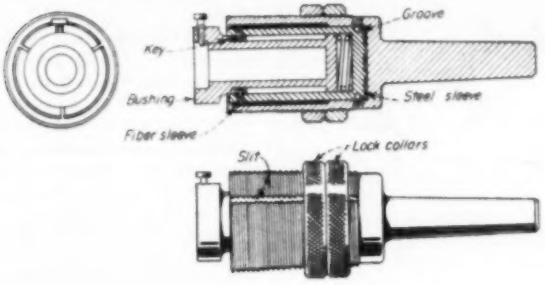


Ball-Bearing Fixture Bends Plates

RECENTLY I had to bend some 1/16-in. stock to right-angle shapes. I wanted to do this with a bench vise, so I made the illustrated fixture.

Two pieces of cold-drawn steel, $^3/_4$ by 4 by 6 in., and a pair of discarded ball bearings were the only necessary material. The bearings and steel slabs were brazed together to make the bearings act as trunnions. One piece of steel was brazed to the inside race of each bearing; the other to the outer race.

Allowing for thickness of stock and for overbending to counteract springback, the work was clamped in the vise with the fixture. This fixture may look crude, but it's fine for short jobs, and produces good, straight bends. *George C. Best, New Bedford, Mass.*



Friction Tap Driver Has Tightness Adjustment

WHERE THE SMALL SHOP has to cut a small number of threads every once in a while, a device like this tap driver is an efficient tool to have handy. The illustrated mechanism is adaptable for threading and tapping on almost any machine where the spindle can be reversed.

The body has a tapered shank and a threaded OD. After it is threaded, the OD is slit back three or four times, and two lock collars are assembled. There should be a slight taper on the OD so the collars will tighten the body segments as they move out toward the open end of the body.

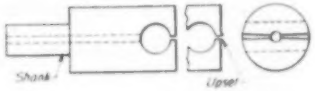
Inside the body, a recess is fitted with a sleeve of fiber or similar material that will have good frictional properties. Inside the fiber sleeve rides a steel sleeve. Its back end is grooved so setscrews through the body will retain it inside the body. Keys are fixed in the wall of the metal sleeve to engage two or three longitudinal keyways down the workholder bushing. These keyways are blind to prevent the bushing from dropping out. A coiled spring behind the bushing prevents it from banging to full depth in the hole, and will therefore prevent damage to the work if the friction grip is adjusted properly.

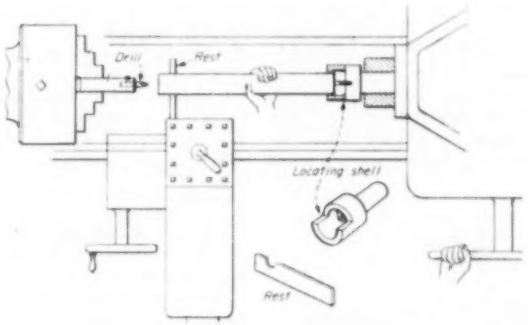
Action is like that of any tapholder, except that the friction feature allows the tap or die to stop on the work to prevent damage if the machine is not reversed at the bottom of the cut. By adjusting the lock collars, the machine operator can rig the mechanism so normal drive during a cut is positive, yet the mechanism will slip when and if the tool bottoms. *N. Bonamini, Glasgow, Scotland.*

Counterbore for Plastics

A PIECE OF DRILL ROD makes a good counterbore for soft and medium-hard plastic materials, when proper angles are ground on its end.

First, drill rod of the hole size is chosen, and the back end is turned down to shank size. A small pilot hole is drilled all the way through the tool. A larger hole is cross-drilled near the working end, and this is broken into by a saw cut from the end of the tool. The lips of the breakthrough are upset, filed, and hardened to make the cutting edges. The upset lips project about as shown. *Bernard Levowich, Brooklyn, Mass.*





Centerdrilling Setup on Turret Lathe

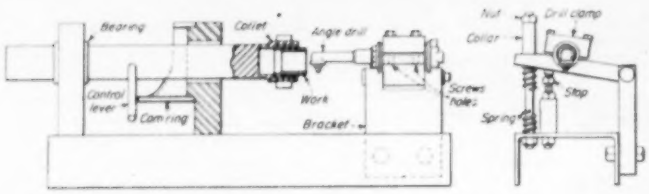
LARGE BATCHES of medium-size round stock have to be centerdrilled in our shop in preparation for turning operations. When one of these comes up, we have three tools that are installed on the lathe.

The first is the centerdrill, which is setscrew-held in a hole in a piece of bar stock. The stock is chucked, and is centered exactly.

The second is a piece of flat stock with half a circle cut out at one edge. This is clamped in the toolslide turret so the half circle is concentric with the axis of the chuck.

The third is a bar that is held in the turret. This has a counterbored collar on its end. The collar was turned, bored, counterbored, then milled off to leave a sort of half shell into which the end of the stock can be dropped. A setscrew into the bar acts as an end stop.

Work is dropped in both gripping pieces and is held by hand as it is centerdrilled. The toolslide remains stationary, but slight traversing of the turret carriage moves the work against the centerdrill. Operation is fast and accurate. *J. C. Salinas, Corpus Christi, Texas*



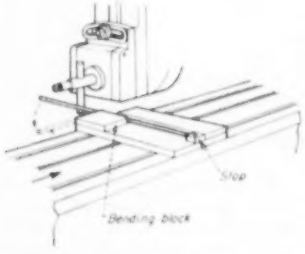
Pneumatic Angle Drill Cuts Bearing Grooves

A SIMPLE RIG, made of available parts, cuts oil grooves inside bearing shells for us. Because it is pneumatic and hand-powered, the mechanism doesn't take up valuable machine-tool time or space, and therefore saves us machine capacity.

The base is a large channel. At one end a vertical bracket pivots an arm that holds the angle drill. Vertical screws on the opposite side of the base have springs to hold up the arm, and nuts and collars to press it down against spring pressure; allowing fine adjustment of the drill location, which controls depth of cut. An adjustable stop prevents the drill from being forced down too far.

Two heavy bearings at the other end of the base support a main shaft, at one end of which is a split collet that grips the bearing to be cut. Attached to the bearing support nearest the drill is a ring cam, cut so its contour is an exact duplicate of the cam shape we want to reproduce. This can be changed easily to produce different cam shapes.

The control lever threaded into the main shaft is manually rotated as it is pressed against the same ring, making the bearing shift against the drill so the oil groove is reproduced. It is cut so a lead-in groove parallel to the axis of the bearing will be machined, and so helical curves will be cut inside the bearing shell. *S. H. Pearson, Glasgow, Scotland.*



Planer Fixture Bends Bolts

AN EASY WAY to bend ½-in. anchor bolts is to make a planer setup like we did recently for a batch of a thousand pieces. Our planer had ample power to bend the bolts without strain, and the fixture assured accuracy.

The baseplate, clamped on the table, was fitted with a backup block and a bending block; both welded to the base. A small stop was located next to the backup block to gage the position of the bends on the bolts.

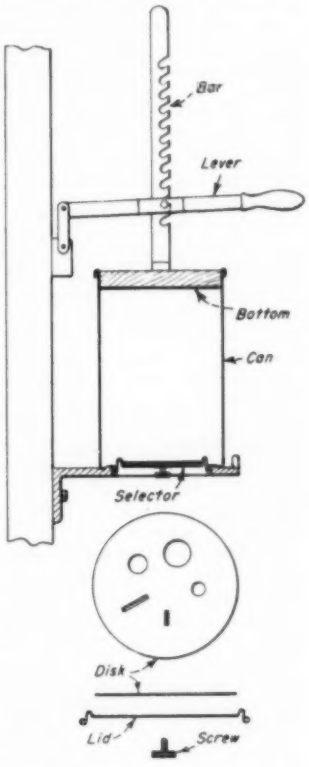
We found it unnecessary to clamp the work. The 1½-in. steel bar clamped on the planer toolblock bent the work easily, and all we did was feed a new part into the fixture, after pulling out the finished one, at each stroke of the table. For backlash allowance, we could have ground back the clearance edge of the bending block and turned the base at a slight angle, although in this case it was not necessary. *Stanley Hodge, Barria, Ont.*

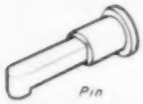
Grease-Gun Pump

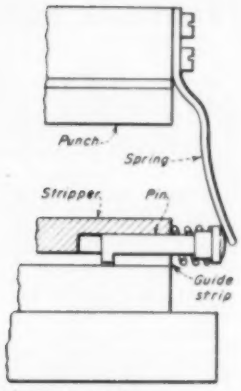
TO SAVE GREASE when the can is nearly empty, and also to keep things neater and cleaner, we rig a simple pump against the shop wall.

First, the new can is opened and our selector disk is added inside the lid. This is held by a knurled-head screw, which allows rotating the disk when we want relatively small or large amounts of grease. The disk also cuts off the supply completely. To pass the grease, a hole is cut in the lid, too.

Then the lid is jammed back on the can, and the can is set in a wooden holder attached to the wall. A wooden disk, acting as a piston, is set inside the bottom of the can (which is up), and the lever-arm pin is moved into one of the slanted slots in the vertical bar attached to the disk. The arm is linked to a bracket on wall so downward pressure will force down the piston, delivering grease. The bottom of the can will be forced down, which will not do any harm. *J. C. Salinas, Corpus Christi, Texas.*







Guide-Strip Takeup Counteracts Width Variations

WHEN MATERIAL is in short supply, and production lines are operating with whatever material they can get their hands on to do the job, the toolroom often must cope with unusual problems. When, for example, the press shop is supplied with strip material instead of rolls, and when stock width varies a lot, a special gadget has to be added to a press guide strip to align the stock.

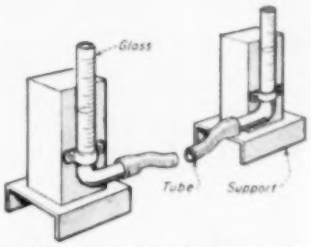
One guide strip is fitted with the automatic adjusting mechanism. The stripper is milled out to take a pushrod that is loaded by means of a coiled spring under its head. A piece of spring steel on the die forces this rod against the stock on each downstroke, forcing the stock against the other guide strip each time.

Three limiting factors control pushrod action: The slot in the stripper must be deep enough to allow the pushrod movement for the narrowest stock to be handled. The guide strip must be slotted or cut back to allow the foot of the pushrod to clear the widest stock when the press is open. The leaf spring must move the pushrod before any punches or pilots enter the stock. Any number of pushrods may be installed. *Howard Morgan, Campbell River, B. C., Canada.*

Tube-Connected Elbows Level Large Fixtures

WE HAD A NUMBER of long aircraft fixtures to line up so brackets at distant points would be level. The usual piano-wire method of alignment was replaced by this extended level, which may have applications in other shops, too.

The bend glass tubes are clipped to steel blocks. Graduations are etched to any convenient scale. The important point is to make them equally spaced from the bottom of the steel block in each assembly. The glass tubes can be made adjustable.



This method works rapidly, and is versatile because any rubber tube can connect the glass tubes, allowing practically any reasonable length between parts of a fixture. *R. G. Vare, Christchurch, England.*

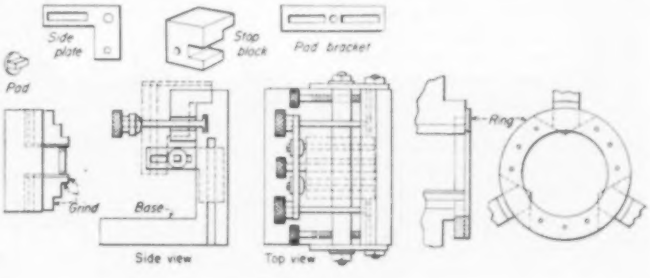
Truing Chuck Jaws

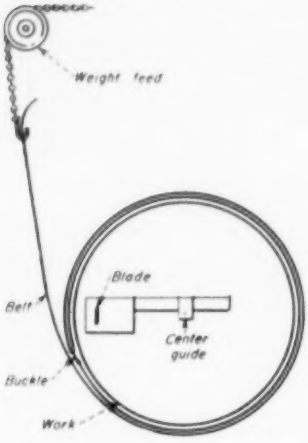
THERE HAVE BEEN PUBLISHED a number of methods for truing up the jaws of universal and four-jaw chucks (*AM* May 14 '51, p 164) but none have seemed completely satisfactory to me. Here are two methods I have found to be both unusual and effective:

(1) First, chuck a disk at the front edge of the jaws, and grind off the first step, both surfaces, and the front surface of the last step with a toolpost grinder until all are equal in projection. Check with a dial indicator.

Next, remove the jaws and locate them in the illustrated kind of fixture, where the jaws rest with their ground steps on the ground notched edge of the fixture plate, and with the opposite jaw steps resting against a rod through the fixture. Clamping is done with a yoke. A setscrew holds the middle jaw tight, and two rounded pads hold the outer jaws. The bracket that mounts these pads and the setscrew is slotted so the pads can be spread to take wider chuck jaws. Stop blocks slotted to clear the clamp rods locate the jaws from the two sides. These are not shown in the top view for simplicity. This fixture is made so special forms and shapes can be ground on chuck jaws, as well as truing work. After setup, the working edges of the jaws are ground even.

(2) A second method involves a shouldered ring. This is notched out to clear the jaw ends when they grip it. Backlash in the chuck is taken up this way while the gripping faces of the jaws are ground with a toolpost grinder. *R. H. Fry, Croydon, England.*





Belt and Buckle Power-Feed Saw

FOR CUTTING OUT DISKS or inside circles in metal parts, we connect the weight-feed attachment of our DoAll to the work by means of a belt wrapped around the OD of the work—even when the work is not regular in shape.

This rotates the work accurately around the center guide on the table. It may be necessary to reset the belt during the cut because of the limited length of feed movement, but this can be done easily if the buckle is a clamp type.

The last inch or so of the cut should be done by hand to prevent the sawblade from cutting too far into the outer ring of work. *Harold Gobstein, New York, N. Y.*

Turret Chip Breaker Clamps Next to Tool

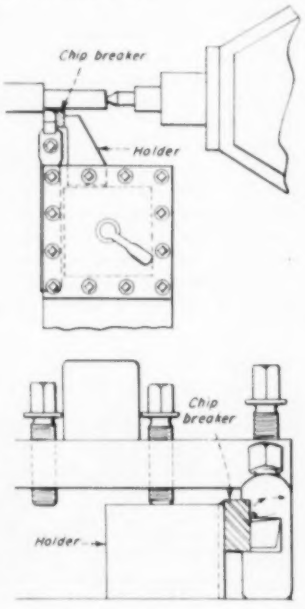
ALMOST ANY TOOL held in a square turret holder can be provided with a chip breaker in this manner.

Cut a simple block of steel, almost as long as the projection of the tool, and somewhat higher. Then cut a plate so it can be set in the turret, locked with one of the turret screws, and so it will bear against the block when it is located. The block is clamped this way next to the tool, where it will break up chips. *J. C. Salinas, Corpus Christi, Texas.*

Converting Skid Boxes For Long Stock

WHEN PARTS are too long to be dumped into an ordinary tote box or skid box, a welded-pipe adapter can be made to slip over each side of the box to a rod carrier out of it.

For each adapter, seven lengths are needed. The adapters allow quick conversion, and they cost little and don't add too much weight to the box. *H. G. Frommer, Milwaukee, Wis.*



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PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES— A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS— Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worrry about your shortcomings as a draftsman, photographer or author —every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product — in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER – Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

145th Winner:

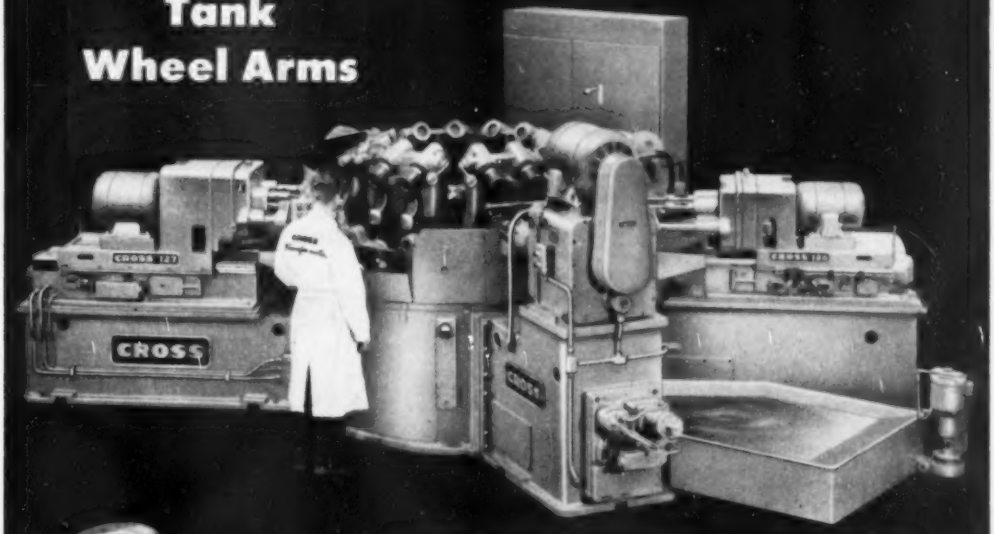
(For January 7 issue)

Robert Laimboeck

Ten Shop Tools

Drills, Chamfers and Taps Tank Wheel Arms

Another Special by Cross



- ★ Drills, chamfers and taps four holes; drills chamfers and reams one hole in Tank Intermediate and Rear Wheel Arms.
- ★ Material—Cast Armor. Hardness—Rock. C35
- ★ 64 pieces (32 right and 32 left hand) per hour at 100% efficiency.
- ★ Duplex work holding fixture holds one right hand and one left hand part in each station.
- ★ Six-station power operated index table, including one for loading, two for drilling, one for chamfering, one for reaming and one for tapping.
- ★ Other features: Fluid motor index drive, J.I.C. standard construction with stranded wire, hardened and ground ways, hydraulic feed and rapid traverse, individual lead screw feed for tapping, Sav-A-Tap spindle construction.

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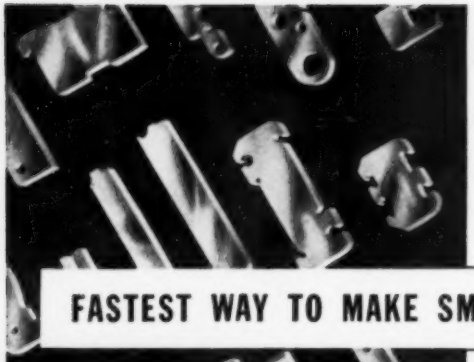

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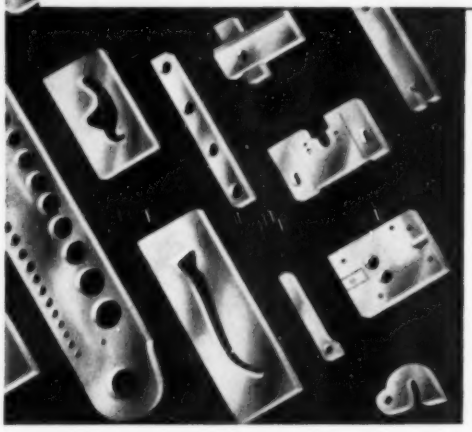

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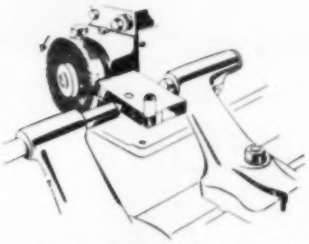
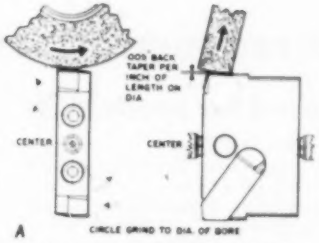
American Machinist REFERENCE BOOK SHEET

How to Grind Boring Tools . . . I

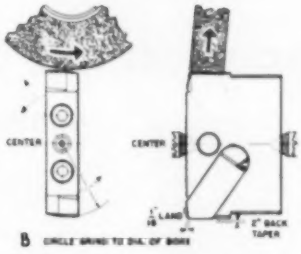
BY E. J. KAISER, Manager, Davis Boring Tool Div., GIDDINGS & LEWIS MACHINE TOOL CO.

Step 1—CIRCLE GRIND TO DIAMETER OF BORE



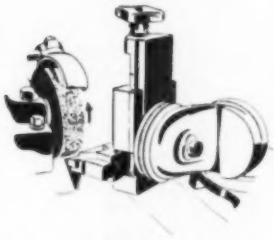


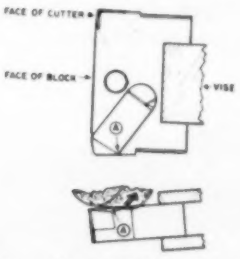
A—For roughing and finishing steel, malleable iron, bronze and cast iron, swing table to produce back taper of 0.005 in. per in. dia. For roughing cast armor plate, employ back taper of 0.025 in.; for finishing 0.005 in. Before grinding, note results produced by Step 3



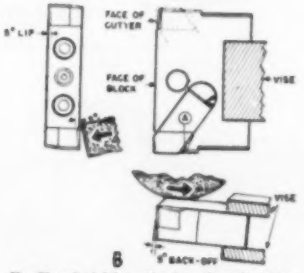
B—For roughing and finishing aluminum, duralumin, copper, etc., allow 1/16 in. land on dia; swing table to produce 2° back taper

Step 2—GRIND TOP RAKE and/or LIP (HSS and Cast Toolbits)

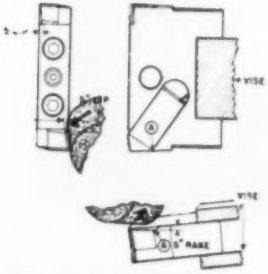




A—For roughing steel and malleable iron, and roughing and finishing bronze, grind top rake diagonally through point *A*



B—For finishing steel and malleable iron, grind 5° lip with radius of wheel starting at point *A*



C—For roughing and finishing cast armor plate, aluminum, copper, etc., grind combination 5° lip and 5° rake diagonally through *A*

Block-type boring tools can be ground by four or five easy steps that have been shop tested over a period of months. The accompanying instructions and illustrations apply to HSS and cast-alloy tool materials. Carbide cutters can be ground in the same manner, except the top face which is preground. All views show grinding down on the cutting edge, which is especially important with carbides. Before any grinds are started, all toolbits, new or used, must be squared off with the face of the block. A universal cutter grinder with centers or universal vise is employed for all grinding operations on block-type tools.

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Continuous Type Broaching Machine Built in Four Sizes

Stub Type Cylinder Boring Machines

FOOTBURT LINE OF PRODUCTION MACHINES

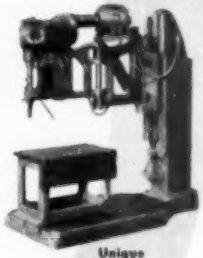
engineered for production

1, 2, 3, 4 and 6 Spindle Sensitive Drilling Machines

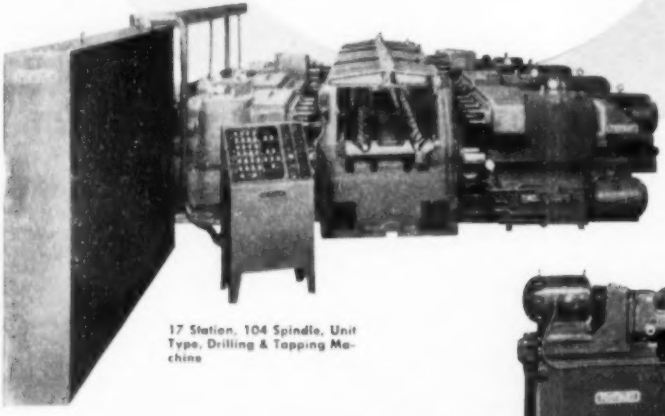
Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways . . . Station Type Machines . . . Center Column Type Machines . . . Cylinder Boring Machines . . . Inverted Drilling Machines . . . Surface Broaching Machines . . . Sensitive Drilling Machines . . . Hammond Radial Drilling Machines . . . Hammond Surface Grinding Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . . Special Machines.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

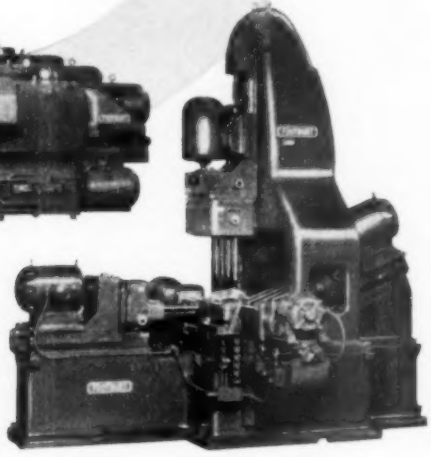
Detroit Office: General Motors Building



Unique Bracket Type Hammond Radial Drilling and Tapping Machine



17 Station, 104 Spindle, Unit Type, Drilling & Tapping Machine



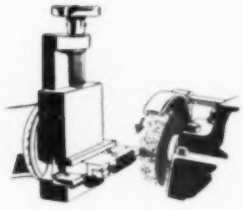
Five Way 21 Spindle Lead Screw Tapping Machine

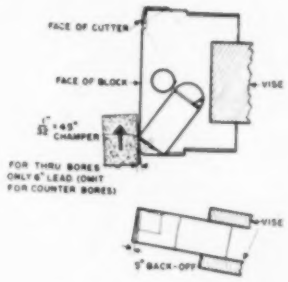
FOOTBURT *production machine tools*

. . . a time tested line of machine tools

How to Grind Boring Tools... II

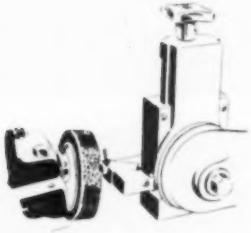
Step 3—GRIND FACE OF CUTTER

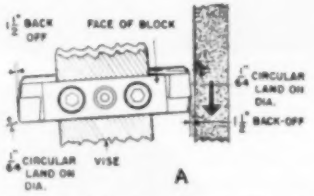


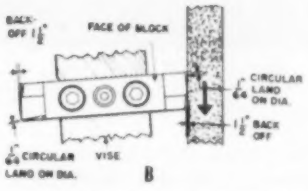


For roughing steel and malleable iron, roughing and finishing bronze and cast iron: through bores—swivel vise to 6° lead and tip up 5° for back-off; for counterbored holes—omit lead angle (swivel vise bottom parallel to table travel) but tip up 5° for back-off. Compensate for the 5° lip needed on tools for finishing steel and malleable iron, and roughing and finishing cast armor plate, aluminum and copper; otherwise, follow steps given above

Step 4—GRIND BACK-OFF ON OD







A—Illustration applies to grinding back-off on tools for roughing steel and malleable iron, and roughing and finishing cast armor plate, aluminum and copper. Follow setup steps (1) to (4), inclusive, except that it is not necessary to swivel the vise (step 1) for aluminum and copper because back taper gives clearance in both directions

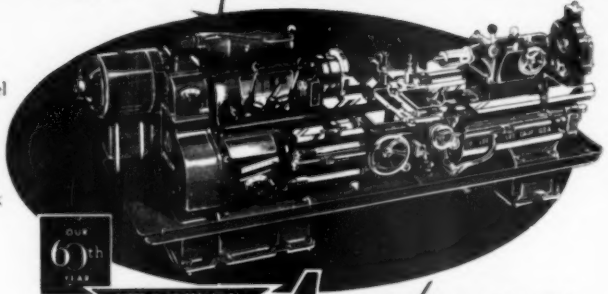
Setup steps: (1) swivel vise to allow for 0.005 in. back taper; (2) tip vise for 1½° back taper; (3) tip vise forward to allow for top rake or top lip, and (4) grind to leave 1/64-in. circular land

B—For finishing steel and malleable iron, also roughing and finishing cast iron, swivel vise to allow for 0.005-in. back taper. Tip vise for 1½° back-off taper. Grind to leave 1/64-in. circular land

Step 5—BREAK CORNERS AS NEEDED (1/32 in. x 45 chamfer)

QUIET • SMOOTH • TOUGH

When you case-harden and precision-grind an alloy steel headstock gear the way AXELSON does it, you get one that not only operates smoothly—it stays on the job, offering high resistance to wear, to shock and to surface pitting. So it is throughout all AXELSON lathes. Quality-built, they deliver dependable accurate work under the most difficult operating conditions.



THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

AXELSON Lathes

CHOSEN FIRST . . . TO LAST

HEAVY DUTY ENGINE LATHES • TOOL ROOM LATHES • GAP BED LATHES

AXELSON MANUFACTURING CO. • LOS ANGELES 58 • NEW YORK 7 • ST. LOUIS 16

Authorized Distributors in All Principal Industrial Centers

American Machinist REFERENCE BOOK SHEET

Measurement of Case Depth

By JAMES SORENSON, Chief Metallurgist, and ALFRED HENDRICKSON, Four Wheel Drive Auto Co.

Carburized case depth is a primary consideration in the service life of gears for transmissions and axles of heavy-duty trucks. Total case depth is the portion of the steel in which the carbon content is made higher than that of the orginal material by means of the carburizing process. But only a portion of the total case depth, known as the effective case depth, has high-enough carbon content to harden file-hard. It is the effective case depth that is important with respect to resistance to wear and abrasion in service.

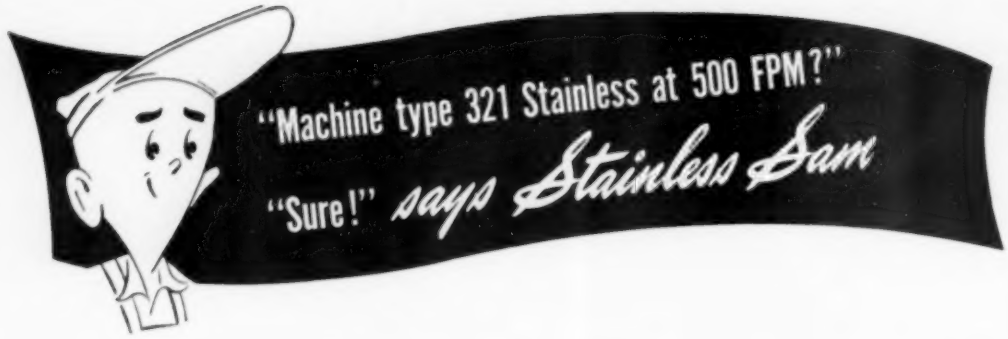
It is not always practical to prepare test specimens for depth of carburized case by polishing and etching samples in a 5% nital solution. Hence, we have prepared the accompanying table for several different steels, showing the Brinell hardness at various depths of carburized case. A Brinell hardness test can be run quickly on each gear if necessary, without injury or damage. For example, if the hardness reading for a SAE 1020 carburized and hardened part is 321 Brinell, the depth of the effective case is 0.074 in.

Certain assumptions must be made in setting up a table of this kind. In each steel specification, we must assume that we are dealing with samples of like hardenability rating, in order to establish a constant core hardness. Also, the carburized case must have sufficient hardenability to produce a file-hard surface. If constant core and case hardness are obtained, the depth of case is the only variable. Consequently, any variation in carburized case depth will be reflected in a Brinell hardness reading not consistent with tabulated values.

Of course, some variation in results may be encountered because of the size and shape of the work. Separate data may be required for special cases. With this reservation, the table can be used for establishing values for routine checking of carburized case depths on individual gears and similar parts after carburizing and hardening.

STEEL	SAE 1020		SAE 6120		SAE 43BV17		SAE 1020		SAE 43B17	
QUENCH TEMP.	1675F	1500F	1675F	1500F	1675F	1500F	1675F	1500F	1675F	1400F
QUENCH MED.	Oil	Oil	Oil	Oil	Oil	Oil	Water	Water	Oil	Oil
Brinell										
156		0.000								
167		0.010								
170		0.014								
179	0.000	0.019								
187	0.007	0.024								
192	0.009	0.026						0.000		
197	0.011	0.029						0.003		
207	0.016	0.035						0.005		
217	0.023	0.041						0.009		
229	0.030	0.049					0.000	0.013		
241	0.035	0.069		0.000			0.005	0.018		
255	0.040	0.077		0.003			0.008	0.023		
269	0.046			0.007			0.015	0.027		
285	0.053			0.013		0.000	0.022	0.034		
302	0.060			0.018		0.004	0.027	0.039		
321	0.074		0.000	0.023	0.000	0.008	0.034	0.046		0.000
341			0.004	0.029	0.004	0.012	0.041	0.054		0.010
363			0.009	0.036	0.009	0.016	0.048	0.062		0.015
387			0.014	0.043	0.017	0.020	0.056			0.021
412			0.019	0.048	0.024	0.025	0.062		0.000	0.027
444			0.026	0.060	0.034	0.031			0.019	0.034
460			0.030		0.039	0.034			0.024	0.038
477			0.034		0.044	0.037			0.028	0.042
495			0.038		0.050	0.040			0.033	0.047
512			0.042		0.055	0.043			0.038	0.051
532			0.046		0.062	0.047			0.043	0.055
555			0.051			0.051			0.049	0.061
578			0.057			0.054			0.055	
600			0.062			0.060			0.061	
627										

STEEL	SAE 4615		SAE 8620		SAE 3310		SAE 4820		FWD Krupp	
QUENCH TEMP.	1675F	1500F	1675F	1500F	1675F	1500F	1675F	1500F	1675F	1500F
QUENCH MED.	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil
217		0.000								
229		0.004								
241		0.009								
255		0.015								
269	0.0000	0.021								
285	0.0070	0.024		0.000						
302	0.0100	0.028		0.005						
321	0.0130	0.032	0.000	0.009						
341	0.0170	0.035	0.003	0.012				0.000		
363	0.0210	0.039	0.005	0.016	0.000	0.000	0.000	0.004	0.000	0.000
387	0.0240	0.041	0.010	0.022	0.012	0.005	0.008	0.010	0.016	0.009
412	0.0300	0.045	0.016	0.027	0.018	0.009	0.012	0.015	0.030	0.021
444	0.0330	0.048	0.022	0.035	0.033	0.018	0.024	0.022	0.046	0.030
460	0.0350	0.051	0.026	0.039	0.039	0.022	0.028	0.026	0.051	0.035
477	0.0370	0.054	0.030	0.043	0.045	0.026	0.033	0.030	0.062	0.039
495	0.0390	0.056	0.034	0.047	0.052	0.031	0.038	0.035	0.076	0.045
512	0.0430	0.058	0.037	0.050	0.058	0.035	0.043	0.039		0.048
532	0.0510	0.060	0.042	0.055	0.065	0.040	0.049	0.043		0.055
555	0.0640		0.047	0.061		0.045	0.055	0.049		0.060
578			0.051	0.066		0.051	0.063	0.054		0.068
600			0.055			0.060		0.060		0.075
627			0.061			0.066				



PART: Welded ring 10" in diameter for jet engine. Made of 1" x 2" Type 321 bar stock.

OPERATION: Facing—Rough and finish to 40 micro-inches.
Roughing Cut—approximately 0.125"
Finishing Cut—0.007" to 0.015"

EQUIPMENT: Engine lathe with carbide tools (Steel cutting grade).

PROBLEM: Low production, poor finish, and tool breakage.

A shop with a large production order for these vital parts had estimated machining time at 30 minutes for each ring. Actual time was two hours because of machining difficulties, so production was running way behind schedule. The impact every revolution of the welded section of the ring promoted early tool breakage. Operators also found it difficult to attain the 40 micro-inch finish specified.

That's when "Stainless Sam," Armco's machining specialist, was called in.

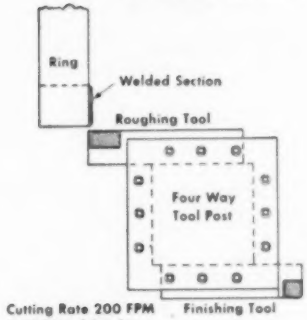
HOW THE PROBLEM WAS SOLVED:

By making the tooling changes shown, "Stainless Sam" found it was possible to increase speed from 200 to 500 FPM. Time for roughing and finishing was reduced to 50 seconds per cut, and finish was within the 40 micro-inches required. Yet tool life was increased many times; and the original goal of 30 minutes machining time for all turning operations was beaten—with minutes to spare.

• • •

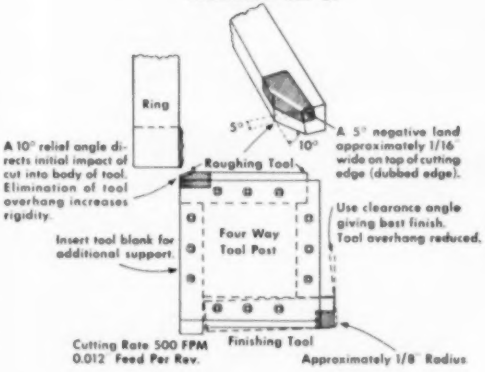
Latest stainless machining practices are discussed at length in Armco's newest edition of the booklet, "Machining of Armco Stainless Steels." Write for your copy today. The speeds, feeds and tooling recommended will help you machine stainless steels readily with standard equipment.

ORIGINAL SET-UP



Cutting Rate 200 FPM
0.012" Feed Per Rev.

MODIFIED SET-UP


Ring
5°
10°
A 5° negative land approximately 1/16" wide on top of cutting edge (dubbed edge).
A 10° relief angle directs initial impact of cut into body of tool. Elimination of tool overhang increases rigidity.
Roughing Tool
Use clearance angle giving best finish. Tool overhang reduced.
Insert tool blank for additional support.
Four Way Tool Post
Finishing Tool
Approximately 1/8" Radius

Cutting Rate 500 FPM
0.012" Feed Per Rev.

ARMCO STEEL CORPORATION

2352 CURTIS STREET, MIDDLETOWN, OHIO • PLANTS AND SALES OFFICES FROM COAST TO COAST • EXPORT: THE ARMCO INTERNATIONAL CORPORATION

TALKING SHOP

To Employees

IN THE PAST THREE YEARS, General Motors has distributed to employees through its Information Rack Service more than 34,000,000 copies of 224 booklets. There are six categories, greatest weight being given social and economic matters, which amounted to 33% of the total. Home and family accounted for 24%; safety and health 14%; inspirational 14%; General Motors information 9%; and scientific and mechanical 6%. Booklets are free for the taking.

Cold Idea

T R FLOWERS of the Tubing & Cables Dept, Texas Engrg & Mfg Co., Inc, Dallas, came up with an unusual idea the other day. He proposed that the sealing block used to seal tube ends with hot wax be refrigerated so the wax would set faster. Turns out the wax sets in a quarter the time—which is important because 100,000 tubes are sealed a year.

Hand Folder

SUPERVISORS at Scully-Jones & Co., Chicago, are instructed to sit down with each new employee and go over company history, policies, benefits, and the like. To assist them and the new employees, the company has produced a simple "handbook," a 9 x 11¼-in. sheet, double-folded to 4½ x 5⅝ in. This is personalized with the name of the new employee on the cover. On the inside spread is a brief history of the company, on the back a list of management personnel. When fully unfolded, the sheet gives all the lowdown on payday, deductions, transfers, holidays, increases, promotions, and the like. At lower right are the name of the new man's supervisor and his clock, locker, and key numbers. Reading time on the folder is 4 min.

Stainless Saved

ONE MAKER of printing equipment produced a roller for printing on cans. It was 40 lb of stainless steel because of the corrosion problem. Now mild steel is used as a base, grit-blasted, and 0.08 to 0.10 in. of stainless sprayed on and finish-ground. That takes 8 lb of stainless, saving 32 lb per roller—about 11 tons a year.

Bread Pans

TWELVE THOUSAND BREAD PANS hold small parts at the Delco Radio Div, General Motors . . . Delco also uses 300 lb a month of unpopped popcorn for polishing.

Flash

WHERE "Reader's Digest" formerly got 1,000,000 copies from the electrotype plates used in printing, they now get 7,000,000. The secret? They give the electros a 0.000050-in. hard-chrome flash. That's all!

Bottles

THE DISTRIBUTION of propaganda by balloon and by airplane has been replaced by a new method in the case of Communist China. Acrylic plastic bottles, bearing in Chinese characters, "Here is important news for you," are stuffed with propaganda messages and set afloat in the China Sea to land on Chinese shores . . . A firm in Milan, Italy, is also making a one-piece aluminum bottle which is extremely light, weighing only half what a tin can would weigh and a tenth as much as a glass bottle. The tapered neck ends in a strong collar, so either pressure or screw caps can be used. The company has worked out a method of lithographing designs on the bottle.

Floating Power

AUTOMOTIVE VEHICLES now on our highways produce fifty times the installed horsepower of all central power stations in the country, according to a recent study by General Motors Proving Ground.

Pensioners

SPECIAL SURVEYS, INC, in Cleveland has recently surveyed 700 retired workers for five companies there. Among conclusions: Pensioners resent company officials' chirping advice on what to do and where to go. They resent efforts to sell them a hobby—if a man has no hobby when he's 50, he's unlikely to develop one later that will hold his interest.

Ingenuity

THIS LETTER, in a childish scrawl, was received at one aircraft plant recently: "Dear Sirs: Would you please send me some pictures of airplane engines and jet engines if possible because in our school I'm not doing so hot in science and our science teacher was a pilot in the war and knows something about airplanes so if possible would you send me some pictures because I want an A. Fred M."

News of Metalworking

LATEST MATERIALS ORDERS

FERRO ALLOYS — Eliminates the filing of individual requests for allocations of nickel anodes, salts, chemicals, oxides and catalysts by permitting the supplier to lump orders and make a single application to NPA. *(M-80 as amended March 12.)*

CADMIUM — Relaxes controls on use of cadmium to permit its unrestricted use in items or processes specifically defined and to fill orders bearing the ratings A, B, C, E and Z-2. *(M-49 as amended March 14.)*

DIAMOND GRINDING WHEELS — Places restrictions on users and manufacturers of diamond grinding wheels to conserve diamond crushing bort and make a more equitable distribution in the trade. *(M-103 March 13.)*

PASSENGER CARS — Revokes order regulating production of passenger cars by integrating automobile production into the Controlled Materials Plan. Restrictions on automatic transmissions and use of secondary aluminum in manufacture of aluminum engine pistons remain in effect. *(M-65 revocation March 14.)*

PRICING ORDERS

RETAIL MACHINERY SALES — Grants manufacturers the option of establishing their own ceilings under the same regulation they used to establish ceiling prices to all other classes of purchasers. *(CPR 30, Amdt. 32, effective March 15.)*

American Machinist Index of Metalworking Prices Announced

NEW YORK—A new statistical tool for metalworking management — a metalworking price index—is presented here for the first time by AMERICAN MACHINIST. This new gage for businessmen covers all metalworking fields.

Revision of the wholesale price index classification system by the Bureau of Labor Statistics makes it possible for AMERICAN MACHINIST statisticians to put together these price indexes shown in the charts below.

The over-all metalworking price index (see chart page 78) is directly comparable in industrial coverage to the over-all metalworking production index carried each issue on the Gaging Metalworking page.

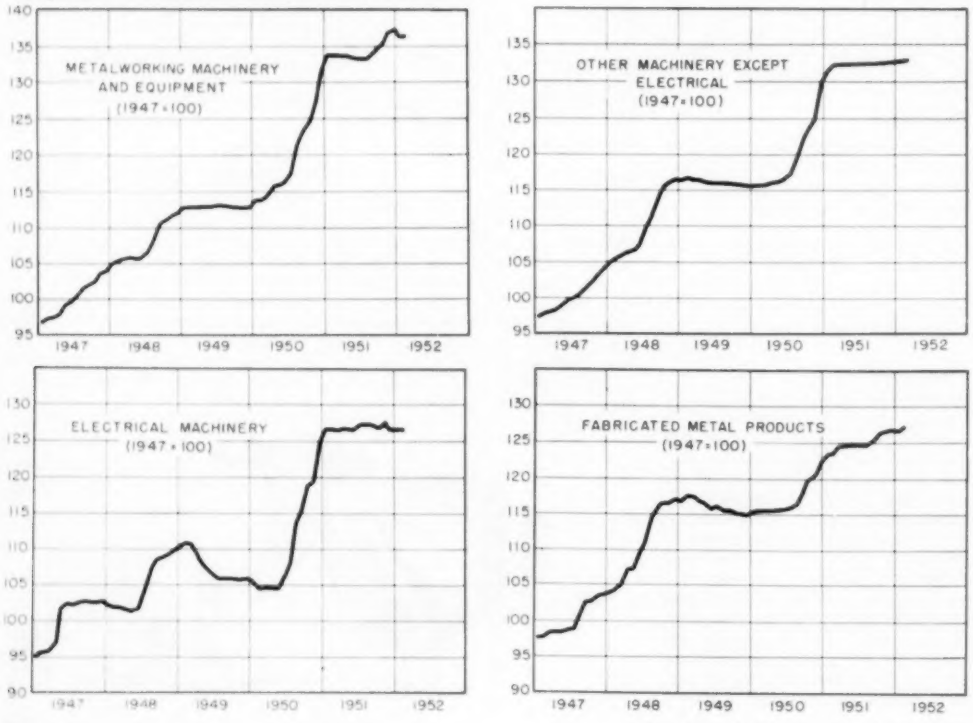
The base 1947=100 was chosen because in the near future the metalworking production index will be revised to the same base.

• **Price indexes cover monthly** price movements from January 1947 to date. The number of commodities covered in the index totals 554. Major groups in the index are metalworking machinery and equipment, other machinery except electrical, electrical machinery, and fabricated metal products.

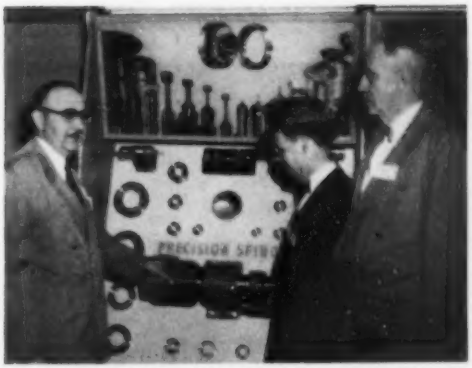
The group index with commodity coverage and relative importance (based on value in trade) in the base period are as follows:

	No. of commodities	*Relative importance*
Metalworking machinery & equipment	82	6.7%
Other machinery except electrical	255	30.2
Electrical machinery	62	10.3
Fabricated metal products	155	52.8
	554	100.0%

Components of American Machinist Price Index



Robert E. Wolff, assistant marketing manager, Illinois Tool Works, and Charles P. Martin, Reed Roller Bit Co., Houston, Texas, talk about hob applications at the ASTE Industrial Exposition at Chicago



D. H. McIver, vice president in charge industrial sales, Ex-Cell-O Corp.; T. J. Gilchrist, chief process engineer, Hughes Gun Company; C. S. Lord, works manager, Hughes Gun Company, Houston, Tex., in Ex-Cell-O booth

Foreign Machines Dominate ASTE Tool Show

CHICAGO—Foreign machine tools dominated the ASTE Industrial Exposition here March 17-21. Several large booths and a number of smaller ones showed European machine tools in wide variety, most of them operating. Attendance at the show surpassed expectations, reaching 25,000 by the third day. There were something over 400 exhibitors, showing machine tools, toolholders, toolbits, materials, and precision gaging equipment.

An extensive program of technical papers was presented for the annual meeting of the American Society of Tool Engineers during the same period.

Next annual meeting of the Society will be held in Detroit, March 17-21, 1953. ASTE plans to hold its next industrial exposition in Philadelphia in March 1954.

American Equipment Displayed

Taft-Peirce exhibited a new optical rotary table, 16-in. dia, controllable to 5 sec of arc, and said to be repetitive within 1 sec. Two new precision levels were also shown by the same company, reading to 0.0005 and 0.0003 in. respectively.

Atlas Press Co. showed the new line of Atlas-Clausing 12-in. lathes and 18-in. drillpresses. The latter have a capacity of ¾ in. in steel and and 1 in. in cast iron. Manual or power feeds are optional, and spindle has a 6½-in. travel. A new device, the Turnomat, can be applied to any Atlas or Clausing lathe and permits production of long, slender parts, normally made only on Swiss-type machines. Another attachment was a hexagon bed turret unit adaptable to Atlas 10-in. and Clausing 12-in. lathes to convert the standard machine into a turret lathe.

Viking Industries introduced a hydraulic turret drive easily attached to any standard ram-type turret. It provides a continuous or interrupted cycle, rapid traverse, infinitely adjustable feed, dwell, and quick return for all six positions. Entire cycle is set in operation by pulling out a small knob at the front of the device.

• **A new 60-ton press** was shown by Sales Service Machine Tool Co. Features include built-in tie rods and a new type of clutch and brake assembly. The brake is spring operated and is normally held off by air pressure. In the event of air failure, the press stops immediately.

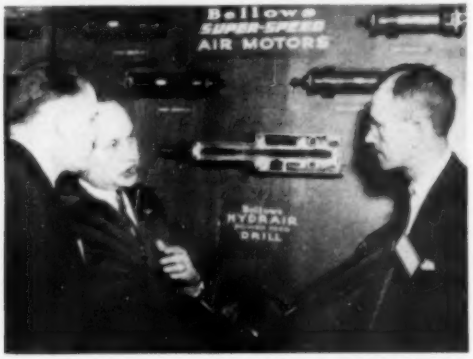
F. J. Littell Machinery Co. demonstrated its own hydraulic rack-and-pinion, feeding and straightening machine for coil stock. The machine is designed to feed a definite length of straight stock, up to 16-in. long, at each stroke of the press. Also shown was a new tilting stock reel operated by an air motor. The latter runs continuously, and the reel is stopped and started by a clutch.

A fully automatic, hopper-fed nut tapper by Ettco-Emrick, operates at 6000 to 8000 rpm and can produce

(Next page, please . . .)

New officers of ASTE—(left to right, front row): Joseph P. Crosby, second vice president; Leslie B. Bellamy, president; Roger F. Waindle, first vice president; (second row): Gerald A. Rogers, assistant secretary-treasurer; Harold E. (Rip) Collins, secretary; Harry B. Osborn, Jr., third vice president; Harry E. Conrad, executive secretary. Howard McMillen, treasurer, is missing from photo

Fred K. Hicks, master machinist, and W. E. Ainsworth, master mechanic, Puget Sound Naval Shipyard, Bremerton, Wash., discuss improved internal micrometer with Wallace E. Anderson, sales director, Brown & Sharpe Mfg. Co.



Paul R. Weotzman, general factory manager, Sheller Mfg. Corp., J. J. Mudd, midwest manager, Bellows Co.; and Lester F. Lotz, tool supervisor, Sheller Mfg. Corp., Portland, Ind., review recent trends in using air cylinders in machine shops

More on Industrial Exposition Held at Chicago

100 to 120 nuts per minute in any size to one-quarter in. Outstanding feature is a new gearless tapping head which can also be adapted to drillpress operation.

• **A new instrument** was introduced by Stocker & Yale the first of its kind, known as a tap analyzer. Developed in conjunction with S. W. Lovejoy of General Electric and constructed by Bryant Chucking Grinder Co., the instrument checks the accuracy of design of taps and measures every element, including hook, lead, surface finish, and concentricity at a single setup, and without injury to the tap.

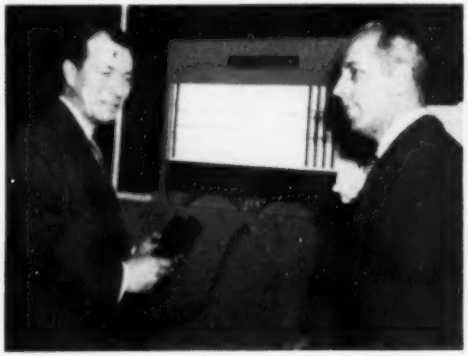
Dynatomic Corp. demonstrated the Dynatomic carbide tool grinder which is said to rough and finish grind simultaneously, and operate without diamond wheels, through the medium of a new coolant fluid, Metalloid X 20, previously described.

A new Kodak contour projector, model 3, was exhibited by Eastman Kodak Co., and Engineers Specialties Div., Universal Engraving Colorplate Co. The machine is designed for fast, routine gaging and can be operated on the open shop floor. Changes from high to low magnification are made by merely turning a dial, and the machine can be converted from surface to shadow images by throwing a switch.

• **A new motor-driven work head** for internal and external grinding was shown by K. O. Lee Co. Operated by a 1/3 hp universal motor, it can operate at 150 and 250 rpm, and can be swiveled 360 degrees.

Hannifin showed a new line of Pilot-Master air valves with a replaceable cartridge containing the piston-actuated poppet valve. Speeds to 600 cycles a minute can be attained. All exposed parts are corrosion resistant, and passages are full pipe size. Any liquid or gas at pressures of 15 to 150 psi can be handled, and operation can be changed or the cartridge replaced without disturbing connections.

Hannifin also showed two new lines of hydraulic cylinders, one



Albert Polk, vice president in charge of engineering, Sheffield Corp., Dayton, shows late model Precisionaire air gaging unit for crankshafts to Joyce Pillsbury, secretary, Century Electric Co., St. Louis

W. H. Panke, gen'l supt. mfg. & tooling, Bridgeport Lycoming Div., Avco Mfg. Corp.; J. Dudley Lockrem, v. p. and sales mgr., Scully-Jones & Co.; L. Etter, master mechanic, Bridgeport Lycoming; Harry Conn, chief engineer of S-J

Del Hansen, superintendent, Tractor Div., J. I. Case Co., Racine, talks with Fred J. Meyer, general foreman, Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., about precision boring problems

Jack Moore, president, Moore-Lowry Research, Tucson, Ariz., discuss precision measuring problems with T. L. Johnson, Jr., vice president in charge of research and development, Federal Products Corp., Providence, R. I.

a 2000-psi Space Saver in nine bore sizes, and the other a series including 1-, 1¼-, and 1½-in. bore cylinders for jig and fixture work to 1000 psi. The Space Saver is "square type" in bore sizes from 1½ to 6 in., and is built to JIC standards. The small cylinders can be used with lubricated air.

Wales-Strippit showed a new "Hydra-Spring" preloaded stripper which actually compresses a special liquid to attain very rapid buildup of end-load and deliveries up to 600% more power.

Foreign Units Shown

Largest booth in the show was that of Cosa Corp., with over 40 foreign machines, including a two-plate rotary lapping machine by Peter Wolters, in which both plates are power driven. The upper plate is arranged to swing completely out of the way to permit the lower to be used independently as a plain flat lap. Also by the same makers was a vertical honing machine designed to operate with a cast-iron lap and a special abrasive. Tool diameter is adjustable in increments of 0.0001 millimeter. An unusual carbide tool grinder, also by Peter Wolters, incorporates an optical micrometer for checking nose radius, and two concentric diamond wheels. Moving a lever causes the outer, roughing, wheel to project slightly beyond the inner one. For finishing, the lever position is changed and the inner wheel projects.

The Sensitast universal lathe, by Heid, Vienna, incorporates an unusual electromagnetic tracer following device capable of direct in and out feed. Ways are not hardened, but are of the inverted vee type and are filled with oil at all times. Leadscrew and rack are inside the bed, which is covered by a telescopic steel plate. Tailstock and steadyrest operate on a separate set of ways disposed vertically at the back of the machine. Headstock is not integral with the bed, so work expansion induces no bending stresses. The same company also showed a toolroom lathe so designed that threads can be roughed with the feed shaft, leaving the leadscrew for light finishing only, and thus preserving its accuracy.

Fire Damages Exhibits

CHICAGO—A fire of undetermined origin in one wing of the second floor the night of March 18 destroyed 14 tools show exhibits, and caused an estimated $750,000 worth of damage. Booths were, however, cleaned up and in operating order the next morning.

The International Harvester display on quality control (see *AM* March 3, p. 153) was destroyed. Among exhibits damaged were those of Eastman Kodak, Taft-Peirce, Republic Gage, Pratt & Whitney Tool, Bryant Chucking Grinder, Stokerunit, Engis Equipment, R. B. Annis, Enco Mfg., Universal Cyclops, and AMERICAN MACHINIST.

• **An unusual turret lathe** with a vertical turret having twelve tool positions was exhibited by Pitler. To change setups, the turret is removed by loosening a single screw and replacing with a completely tooled new turret. Spindle speeds are preselective, and can also be changed automatically at each change of turret position.

H. E. B. Machine Tools, Inc. displayed three French-built lathes, one of which was a regular copying lathe, while a second was an engine lathe with hydraulic copying attachment. The machine is designed for carbide tooling and has speeds from 30 to 2000 rpm. Clutch and brake are foot operated, leaving both hands free. Unusual feature of the copying attachment is that both front and rear tools can be employed. An H. E. B. automatic chuck, made to fit American standard spindle noses, has two cam-shaped, carbide-faced jaws which operate automatically when the machine starts and open when the spindle stops.

MBI Export & Import Ltd. featured the Dixi, Swiss-made, horizontal jig borer in which all coordinate dimensions are set by large dials and adjusted by optical microscopes. Over-all accuracy of plus or minus 0.0002 in. is guaranteed for all operations. The same company also exhibited the Famo semi-automatic carbide tool grinder which employs a special compound finishing wheel. It is claimed that diamond wheels are not necessary when this special wheel is used.

•**A wide range of British-built** ma-

(Next page, please . . .)

... More on Tool Show

chines was exhibited by British Industries Corp., including the Pultra micro lathe. This machine has an 18-in. bed and a 4-in. swing, and is capable of performing all regular lathe operations, including threading and taper turning and boring. The entire exhibit of 40 or more machines is said to have been sold on the opening day.

Several Italian-built machines were shown by Kelvin Systems Corp., including the Dimco high-production vertical milling machine, and the Dimco universal facing lathe (T-lathe).

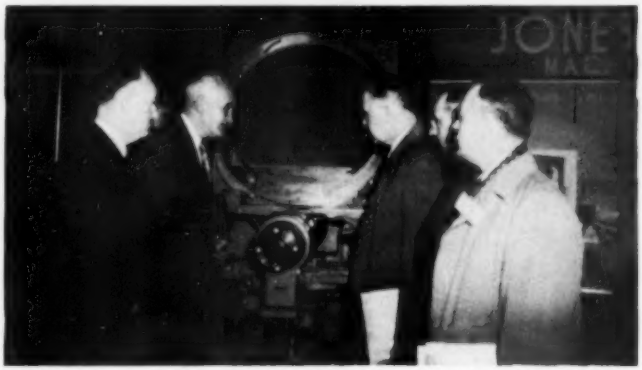
Asquith radial drills were featured by Tri-State Machinery Co. One of these British machines, new to the U. S. market, was the portable, universal machine in which the head and arm can be rotated 360° in any plane, and the column can be moved along the bed.

Guthery Machine Tool Corp. featured the Staehly heavy-duty gear hobber, the Weisser Heilbronn engine lathe, designed to be convertible to a gap-bed lathe and featuring exceptional spindle accuracy obtained by special bearings in the head, and Traub threading machines, pointing machines, and slotting machines.

Morey Machinery Co., Inc., showed Belgian, Danish, and German machines, including Simplex, Selectonic and Viking lathes, and Hommel multi-purpose lathes for turning, milling, drilling and jig boring.

On one Cri-Dan threading machine shown by Lees-Bradner was a special Mendon chuck. Made in France, the chuck is built like a standard 3-jaw unit, with a tiny air turbine and gear train added. Thus the turbine is used to open and close the jaws, but mechanical advantage of the jaw screws does the holding, so the chuck can be hand operated.

Michael Klos, toolroom foreman, Scranton plant, The Trane Company, and J. C. Danly, assistant chief engineer, Danly Machine Specialties, Inc., discuss die-set design in Danly booth



J. C. Hebert, general sales manager, and R. O. Beardsley, chief engineer, Jones & Lamson Machine Co., discuss optical inspection problems with Frank J. Findle, chief inspector, Tools & Forge Div., C. W. Miller, chief inspector, Gearing Div., and John Sekerka, gen'l foreman, Tools & Forge Div., Westinghouse Electric Corp.

New Jet Manufacturing Techniques Shown

LOCKLAND, Ohio—Many new techniques in turbojet manufacture have been developed in the fast-moving year since AMERICAN MACHINIST published the report describing engine manufacture at Lynn, Mass. (*AM*-Feb 5, '51, p. 135-154).

That fact was demonstrated by General Electric at the plant tour and commemorative program held at the Jet Center here March 18 to commemorate the time, exactly ten years before, when the nation's first turbojet was started, at GE's Lynn, Mass., plant.

• **Among more prominent changes:** the shift from horizontal to vertical assembly, and the abandonment of rollover, or trunnion fixtures in favor of simple vertical frames to permit assembly of three engines in space formerly required to assemble one. Fixtures are on wagons guided, trolley style, by a single central rail. As the assembled height increases, the wagons pass between large work platforms, and then, as the assembly is completed, the engines are positioned vertically for checking.

Some of the more interesting operations included a Gleason grinder producing, automatically, a curvic tooth form on coupling flanges; a Lapointe broach automatically cutting dovetails in rotors and using a Hapman tubular conveyor to remove chips as fast as they are produced; a Reishauer gear grinder utilizing a multiple-rib grinding wheel to produce gears three times as fast as conventional methods with greater accuracy of involute form and spacing (wheel is crush-dressed and cleaned up with a diamond).

• **Gear production was improved** by roughing blanks with a Shear-Speed in one step and then finishing by grinding for close tolerances. Blade production time and cost are cut in half by rolling blade material in long strips, cutting to required length, inserting in a separate base, and welding, instead of forging each blade from solid. Instead of the old guillotine method of blade inspection, a Sheffield Precisionaire gage is set up to measure 19 points at one time and complete 10 blades per minute.

The Lockland plant, although incomplete, is producing some engines. Many machine tools have not yet been delivered. However, in light of present rate of change and modification on turbine design, it is felt that too rapid and rigid tooling might be less practical than the flexible program now in effect.

Clifford R. Meyer

Alfred L. Hurst

A. Dean Hunter

Nelson C. Dezendorf

Names in the News

Clifford R. Meyer has been named vice president and secretary of Morris Machine Tool Co., Cincinnati. He has been with the company for the past four years as secretary.

Gerry Attridge, assistant general manager of Lovejoy Tool Co. Inc Springfield, Vt., has been elected a director, succeeding **George Perry,** retired.

Arthur E. Stehle has been appointed Midwest district manager with offices in Chicago for the Ettco Tool Co., Inc., Brooklyn, N. Y.

Irwin T. White has been named sales manager of the Gradall Div. of Warner & Swasey Co., Cleveland. He has been with the firm since 1934.

Zay B. Curtis, Jr., has been appointed assistant to the president, C. H. Wheeler Mfg. Co., Philadelphia. He was formerly assistant plant manager of Fosteria Pressed Steel Corp. and later works manager, Hamilton Thomas Corp.

Alfred L. Hurst, works superintendent of Brown & Sharpe Mfg. Co., Providence, R. I., since 1941, has been named consultant to the vice president in charge of production and engineering, a new position created principally to coordinate many development programs which the company is now undertaking. **A. Dean Hunter,** assistant works superintendent since January 1951, succeeds Mr. Hurst.

Everett E. Lundberg has been named president and general manager, Briggs Mfg. Co., Detroit. He replaces **William Dean Robinson,** who has been elevated to chairman of the board to succeed the late **Walter O. Briggs.**

Harold B. Ridgley has been named tooling superintendent, Texas Engineering and Manufacturing Co., Dallas, Texas.

Ed Swiatek has been appointed sales manager, Diamond Machine Tool Co., Los Angeles, Calif.

Nelson C. Dezendorf has been appointed general manager, Electro-Motive Div., General Motors Corp., La Grange, Ill. Mr. Dezendorf has been with GMC in various executive positions since 1922. He succeeds **B. A. Dollens,** who died February 9.

Otto G. Schwenk has been named vice president in charge of industrial products, Blaw-Knox Co., Pittsburgh. Mr. Schwenk joins Blaw-Knox from the Yale & Towne Mfg. Co., where he had been vice president in charge of production and a director.

J. M. Johnson has been appointed sales manager, Automatic Transportation Co., Chicago. He will direct sales of the company's Transporter line of industrial trucks.

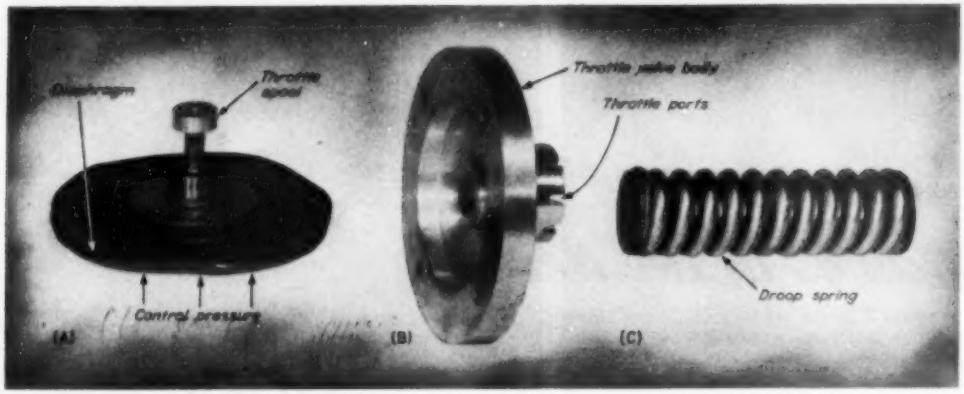
Carlton H. Winslow has been elected vice president in charge of sales, Cuno Engineering Corp., Meriden, Conn. He was assistant general mgr. and has been with the firm for 18 years.

Victor Mancuso has been elected executive vice president and assistant general manager of Axelson Mfg. Co., Los Angeles.

C. W. Thompson (left), named vice president and treasurer, Gardner Machine Co., and **R. E. Price,** named asst gen'l mgr, as announced in *AM* March 3, p205

J. W. Brigham (left) and **J. P. Nugent,** named sales mgr and asst sales mgr, respectively, of Baker Brothers, Inc., as announced in *AM* March 3, p205

New Shop Equipment



When governor unit is assembled, the throttle spool extends through to the throttle valve body and is urged to the left by the droop spring.

When the governor is cut in, the droop-spring force just balances the control pressure force acting on the plastic diaphragm

High-Speed Internal-Grinding Spindles Float on Air Jets

Two units, with a speed range of 35,000 to 100,000 rpm, produce good hole accuracy and finish

PNEUMATIC GRINDING HEAD is claimed to surmount the difficulties usually associated with high-speed spindles and to reduce the skill required to produce hole accuracy and finish.

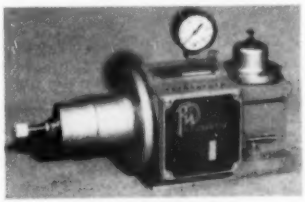
Two units cover the wide speed range of 35,000 to 100,000 rpm. This range provides the most efficient cutting speed (approximately 5,000 sfpm) for grinding wheels or points ranging from 5/32 to ¾ in. in dia. A low-range unit can be adjusted to hold any selected speed within 35,000 to 50,000 rpm and a high-range unit within 60,000 to 100,000 rpm.

The heads operate from an air supply providing approximately 25 cu ft per min at 80 to 100 psi. Normal shop lines are generally sufficient. A line filter cleans the air before it enters the head. It is then distributed through internal passages in the head to a turbine to drive the spindle, a speed-governor control, and to the air-lubricated bearings. Even pressure (no line fluctuation) to the speed-governor control is provided by first passing the air through a regulating valve.

The heads are operated by opening a plug valve between the supply and the turbine with a lever located on the front side. Speeds are adjusted by means of a needle valve, located on top of the head. The pressure gage, in conjunction with a speed chart on the name plate, is used to select the desired speed.

Constant-Speed Feature

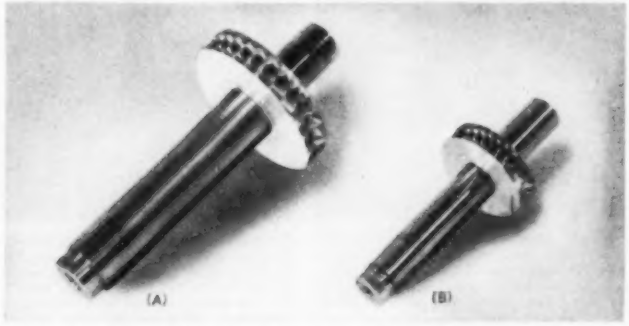
One of the outstanding features of these heads is their ability to operate under grinding load with very small droop from the preset idling speed. The speed governor control, which makes this possible, works on the principle of an air gage to measure the deflection of a ring of whirling cantilevers. Assembled to the inner end of the spindle, these cantilevers surround and nearly seal a small air orifice. As the turbine increases in speed, centrifugal force springs the cantilevers away from the orifice, unsealing it and causing a change in air pressure in the line feeding the orifice. This change in pressure is used to work the throttle valve which supplies the correct amount of air to the turbine to maintain preset speed regardless of grinding load.



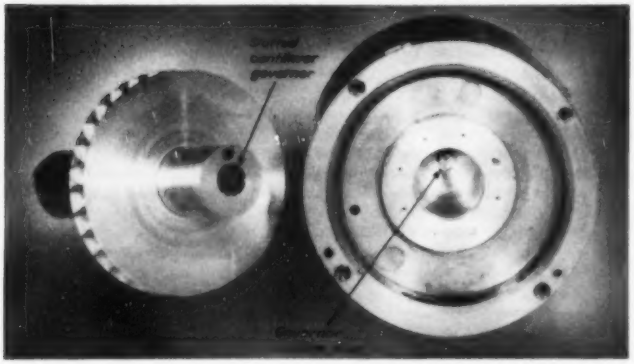
Spindle head for internal grinding features a spindle floating on air jets, excellent speed control, and freedom from vibration. Pressure gage on top of head indicates the nozzle pressure driving the turbine

The pressure gage, mounted on top of the head, indicates the nozzle pressure driving the turbine. As grinding load is applied, the gage reading will increase. This indicates more power air is required to maintain the preset speed. The increase in gage reading is a direct measurement of the amount of work the wheel is doing, and can be used to good advantage to: (1) show instantly when wheel contacts work, (2) gage hole size on the ordinary repetitive job (by using automatic infeed on the grinder), and after kick-off, to remove the wheel from the work when the needle on the pressure gage

Materials and Parts



Spindle and runner assemblies show relative sizes for a complete range of speeds. (a) is for 30,000 to 50,000 rpm. (b) is for 60,000 to 100,000 rpm. Dark lines across front of spindle in (a) shows position of journal jets in air bearing



Cantilevers surround and nearly seal a small orifice at the inner end of the spindle. As the turbine increases in speed, centrifugal force springs the cantilevers away from the orifice, unsealing it and causing a change in air pressure in the line feeding the orifice. This change in pressure works the throttle valve

drops to an established reading. Duplication to 0.0001 in. is possible by this method.

Air Bearing

Another important feature is the air bearing on which the spindle floats. Ball bearings, at speeds above 35,000 rpm, require exceptional care in their construction and maintenance, with the difficulties increasing as the speed is increased toward 100,000 rpm. Simple air-lubricated journals and thrust bearings have no apparent speed limitations, and function as well or better at 100,000 rpm, as at low speeds. The spindle and turbine are floated on air jets and make no metal-to-metal contact with bushings, except when bearing pressure is removed. Thus all rotating parts are free to spin on the center of gravity of the assembly. With a reasonably clean air supply, bearing life should be long. If an accident should cause metal-to-metal contact during operation, the bearings would not be damaged beyond the necessity of cleaning with a fine hand stone. The heads can be operated at any angle and still run cool, even at high speeds.

When first mounted, new grinding wheels are often eccentric and potentially dangerous if run at high speed for truing. As a safety feature, the head can be operated at any speed down to zero for truing.

Pratt & Whitney Div. Niles-Bement-Pond Co., West Hartford 1, Conn.

...INCLUDING

Drillpress with a variable throat and a head that can swing 360° around a horizontal axis takes the place of costlier machines ..... page 140

Straightening press provides two-dimension work positioning hydraulically ..... page 142

Hand screw machines, for secondary operations, employs dual V-belts ..... page 144

Air-operated collet holder can be used in multiple on indexing tables ..... page 148

Fractional-hp motors weigh 51% less per hp and can handle thrust loads in any direction — such as vertical installations.... page 150

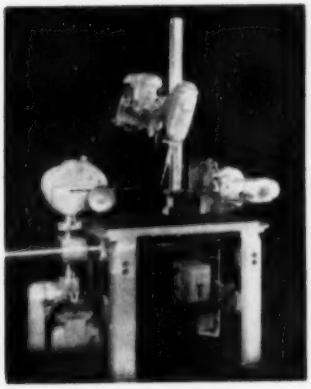
Boring machine employs an automatic-transmission spindle head and automatic trip..... page 156

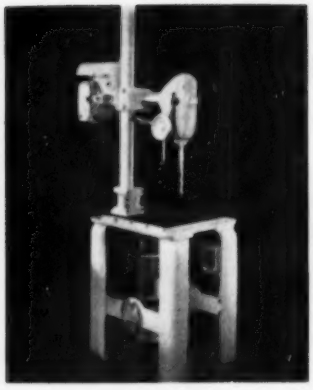
NEW BULLETINS for your shop Library, including 32 8-page bulletins on good grinding practices ..... pages 147 and 148

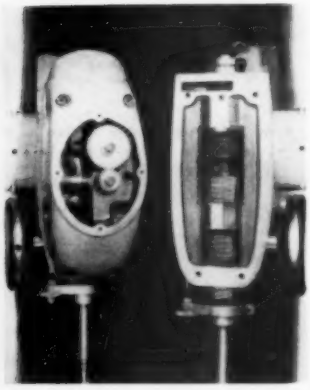
...and in April 14

A shockless indexing turntable for automation devices and special machinery.

Grinder has special features to handle jet-engine compressor wheels and similar work.







Drillpress is available in two models. Single spindle with short table and two spindle with a larger table. Up to four units can be attached to the large table in vertical and horizontal positions. The tables are pre-drilled and tapped, both top and bottom, in a variety of locations. The vertical-column bases have two machined faces and are drilled with a square pattern for quick mounting to table, either vertically or horizontally. The hand feed wheel and quill return spring may be quickly changed to either side of head for different operator preference

Power-feed unit can be easily attached to head by simply removing cover plate. Push-button in housing face or 24-v ac solenoid can be used to trip feed engaging latch. The solenoid permits remote control of one or more feeds simultaneously or in sequence

Drillpress has Variable Throat, Swinging Head

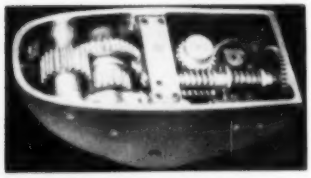
Capacity, steel	¾ in.
Spindle-speed range	251 to 6860 rpm
Stroke	5 in.
Throat	6½ to 14 in.
Power feed	0.0025, 0.005, 0.008, 0.012 ipr
Drill-point pressure	100 to 1000 lb
Maximum clearance	32 in.
Head motor	1 hp

Magna drill consists of a standardized, individually powered, adjustable drill head with a mounting system of ground-steel tubes and joint castings that permits unlimited flexibility in locating any number of spindle axes independent of each other. Each spindle operates individually with the proper rpm, correct feed rate, pre-set drilling pressure, and depth limitation for the operation it is performing.

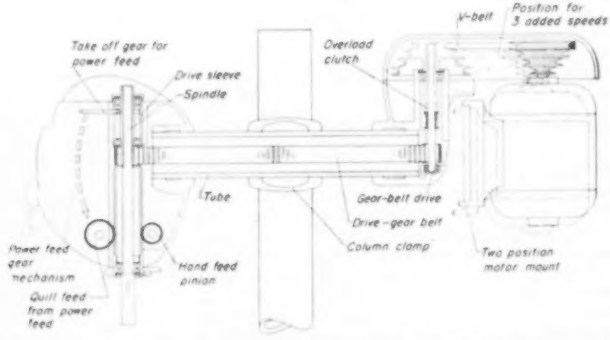
The drill-head tube, which is always perpendicular to the vertical-column tube, permits two additional degrees of freedom not previously available to drillpresses. These are rotation of the head through 360° around the horizontal tube, and displacement along this tube to provide a variable throat. Maximum throat is 14 in., minimum 6½ in. With the drillhead in a horizontal position, throat size can be reduced still further.

The column joint casting has protractors for each tube. Scribed lines on the tubes permit quick vernier settings of simple or compound angular positions to within 15 min of angle. The protractors are mounted in slotted holes and may be zeroed when the machine is first set up.

The narrow head permits drilling on 6-in. centers, and by opposing spindles horizontally, 0 centers can be obtained. A cam-actuated motor mount gives seven instantly available spindle speeds. The feed levers are reversible for right- or left-hand operation. The depth stop has a fine adjustment and can be positively locked. Lifetime-lubricated, sealed ball bearings are used throughout. Column deflection is claimed to be less than conventional drillpresses of the same throat and height. Col-



Gear train in the power feed is driven by spindle take-off gear at top; final pinion at bottom feeds spindle through rack cut into front quill face. Swinging idler gear mounted in a carriage engages and disengages to allow quill return or manual feed. A tension spring connected to the carriage brings the idler gear into engagement when a latch is released by pushbutton or solenoid



Motor mount has a cam lever which lowers motor and pulley one belt width, allowing three additional speeds, or a total of seven. Power is transmitted from jack shaft to spindle drive shaft by a toothed Gilmer Timing Belt running through the horizontal tube. This steel-backed belt drives without slip, therefore operates with the relative efficiency of a gear train. Entire drive-sleeve cartridge is a complete sub-assembly that can easily be removed. It is locked in place by one Allen set screw. The drive is safe—there are no exposed moving parts except the chuck

umns are 3½ in. dia. with ⅜ in. wall.

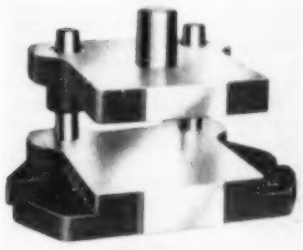
Tables are made of cast iron, surface ground top and bottom; drilled and tapped top and bottom for mounting heads in a variety of positions. The ends are finished too, and have dowel holes for ganging in multiples or attaching a coolant trough.

The drill heads can mount either mechanical or air power feeds. Changeover to either power feed is quick and easy—since they are complete package units driving directly on the quill front.

No. 2 Morse-taper chuck is standard, but No. 3 Morse or No. 3 stub taper are available on special order, at no extra cost.

In brief, the Magna drill removes former limitations on location of drills in relation to work. One or more Magna drill heads can be quickly set to drill to the center of a sphere from any point on the surface of the sphere, operating singly, in unison, or in sequence.

Magna Engineering Corp., Menlo Park, Calif.



New Design in Die Sets

Greater strength is obtained in these sets, with every contour planned to keep weight at a minimum while reinforcing all critical areas. One long, smoothly machined rear pad on the punch-and-die holder assures uniform, accurate location of pin and bushing holes. Straight rear pad also allows considerably more layout and mounting area on the punch holder, as well as on the smaller die holders. All semi-steel die sets have uniform grain structure and high tensile strength.

The Producto Machine Co., Bridgeport, Conn.

Correction: The Merz electronic ball-bearing gaging and segregating machine which appeared in the New Shop Equipment at the Tool Show section in the March 3, 1952, issue was made by:

Merz Engineering Inc., 200 S. Harding St., Indianapolis, Ind.

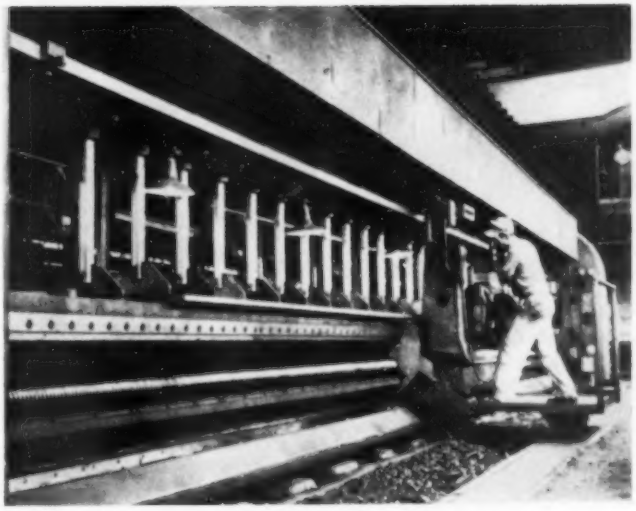


Plate Planer for Welding Bevel Uses Dynamic Braking

Used primarily to bevel steel plate prior to welding, this 40-ft. open-throat planer has a top carriage speed of 45 fpm. With a ⅛-in. feed and a carriage travel of 15 fpm, it removes 34 cu. inches of material a min. from mild-steel plate 1½ in. thick.

The 27 jacking cylinders, operated by 90-psi compressed air are capable of exerting a total of 270,000-lb clamping pressure. They are arranged in six banks of four each and one of three cylinders, so they can be worked in groups, or altogether to clamp any length plate up to 40 ft.

Carriage driving screw is drip lubricated and operates in tension whether cutting right or left. Because it is placed under a slight overhang of the bed at the front, the screw is protected against falling chips and dirt. Cast-iron cradles along the frame support the screw throughout its length, and the anti-friction bearings at the ends take care of thrust load.

The tool carriage is provided with an operator's platform and controls to start, stop, reverse, and jog the carriage. The operating motor slows down and reverses through dynamic braking at end of stroke. In case of power failure near the end of stroke, inertia of the carriage revolving parts cannot damage the planer because sufficient clearance is provided to permit the driving nut to move beyond the screw thread before the carriage touches the planer frame.

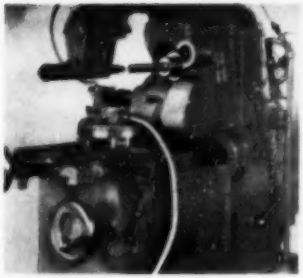
The carriage has two tool heads, and the cross-slides mount on swivel plates. Thus the clapper boxes, mounted on the cross-slides can be swung through an angle of 30°. Two holders are lifted by solenoids to prevent drag on back stroke.

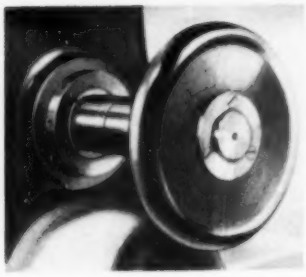
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

Fork Truck for Warehouse Work

Features of this 1500-lb capacity electric fork truck, specifically designed for docks, warehouses and terminals, include: rugged construction; a 59-in. turning radius for maneuverability in narrow aisles; a lifting speed of 50 fpm loaded, and a speed of 6 mph.

Lewis-Shepard Products, Inc., Watertown, Mass.





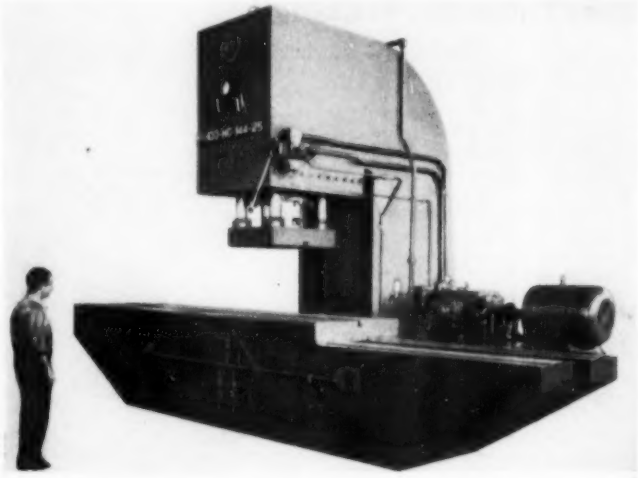
Work-Spindle Design Improved On Hamilton Gear Hobber

Now included as standard equipment on Hamilton No. 1 gear hobbers (small, precision spiral, bevel and face gears, worm and worm gears, gear segments, and pinions) is a draw-bar collet operated by a hand wheel shown in the photo at left. The collet is said to be much faster, easier to operate, and add greatly to the machine's production by reducing time required for loading and unloading.

An additional feature of the spindle design is the adjustable spindle nose which assures trueness of the work piece to within 0.0001 in. and simplifies the necessary adjustment for trueness when a change is made from collet to workholding fixture.

Independent selection of speed, feed, and indexing is not changed by this improvement of the hobber.

Hamilton Tool Co., Hamilton, Ohio



Two-Dimension Work Positioning On Bliss Straightening Press

Quick positioning is obtained by hydraulic systems which move the press bed from side to side and the plunger assembly from front to back at the touch of a lever. It allows a number of blows to be struck at different places on a single piece without changing the press table setting.

Operation speed is further increased by a quick advance and return feature of the hydro-dynamic circuit which allows the slide to advance rapidly to the work and then slow up and do the actual straightening at slow speed, while returning to the up position rapidly.

Operation is simple: Levers on the front of the bed control the front-to-back motion of the ram, the side-to-side motion of the bed, and the conventional up-and-down motion of the slide. Once the work is positioned under the ram, a fourth lever located on the front of the press crown locks it in position and transfers the pump output to the system controlling the up-and-down motion of the plunger. Press capacity is 100 ton.

The Hydro-Dynamic circuit consists of a high-speed variable-delivery rotary pump which controls pressing speed and reversal without numerous controlling valves. Action is quicker and subject to less line friction.

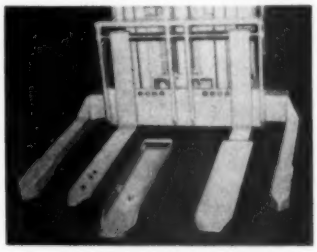
E. W. Bliss Co., Canton, Ohio

Soldering-Gun Heat is Finger-Tip Controlled

This soldering gun is a transformer soldering device which heats instantly in 3 to 5 sec. when trigger is pressed. It cools when the trigger is released. Built-in spot light illuminates work. A long tip on the gun aids in reaching usually inaccessible spots.

It operates on 250 watts, 110-120 v ac. Soldering tips are replaceable.

Wen Products, Inc., 5806 Northwest Highway, Chicago 31, Ill.



A TELESCOPING-FORK EXTENSION for use on the Raymond Corporation's line of electric trucks remains on the elevating forks at all times. Formed-steel channel sections with a retaining bar welded underneath fit over the regular elevating forks. A locking pin welded to the fork extension drops into any one of a series of holes drilled in the elevating fork, making it possible to extend the fork to several desired lengths. — *The Raymond Corp., Greene, N. Y.*

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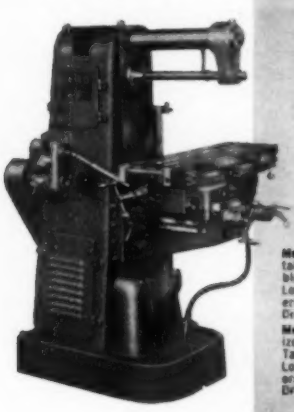
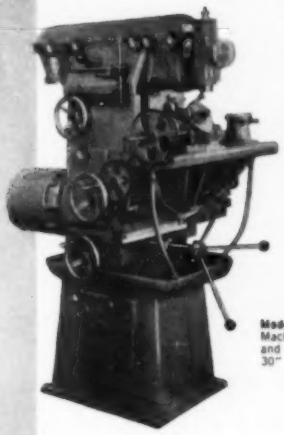


HERO

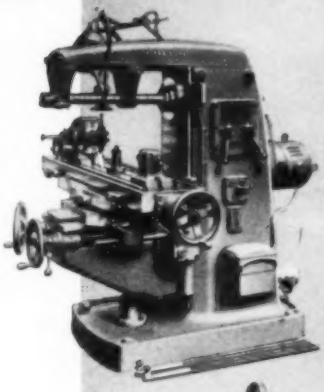
Model 4P Plain Horizontal Milling Machine. Table size 30" x 9½". Longitudinal table traverse 20". 2 HP Motor Drive.

Model 4U Universal Horizontal Milling Machine. Table size 30" x 9½". Longitudinal table traverse 20". 2 HP Motor Drive.



S.A.B.C.A.

Model JRC2 Vertical Milling Machine with Swivel Head and Swivel Table. Table size 30" x 9½". Motor Drive.



JASPAR

Model 2CR Universal Horizontal Milling Machine. Table size 37½" x 8¾". 2½ HP Motor Drive.

Model 3CS Universal Horizontal Milling Machine. Power rapid traverse. Table size 49" x 13". 6 HP Motor Drive.

Model 3CR Universal Horizontal Milling Machine. Table size 52" x 12". 5 HP Motor Drive.

Model 3MCB Universal Horizontal Milling Machine. Table size 52¾" x 12". Power rapid traverse. 6 HP Motor Drive.

Powerful, accurate, new production and toolroom millers, Plain and Universal types, Horizontal or Vertical. They are extremely flexible machines designed and built for heavy duty . . . And backed by MOREY, builders, rebuilders and distributors of machine tools for over forty years.

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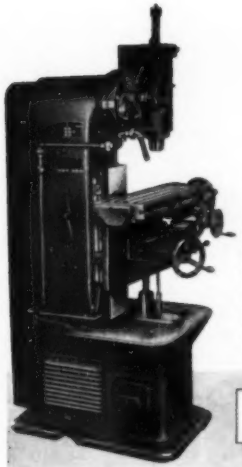
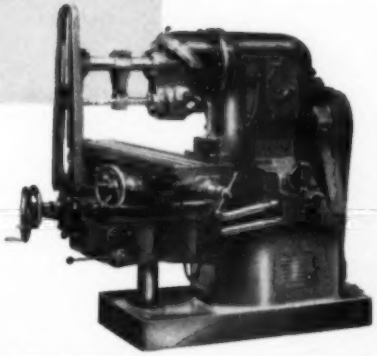


STEINEL

Model SV 4B Universal Head Vertical Milling Machine; swivel head. Table size 29" x 8". 1½ HP Motor Drive.

Model SH 4A Hand Feed Horizontal Milling Machine. Table size 7" x 30". 1½ HP Motor Drive.



HURÉ

Model 73 Universal Milling Machine; swiveling Universal Milling Head. Power Rapid Traverse. Table size 57-3/32" x 12-13/64". 5 HP Motor Drive.

Model 74 Universal Milling Machine; swiveling universal milling head. Table size 64-15/16" x 13". Power Rapid Traverse. 6 HP Motor Drive.

Model V274 Vertical Milling Machine; swivel head type. Working surface 63" x 14-61/64". Power Rapid Traverse. 7 HP Motor Drive.

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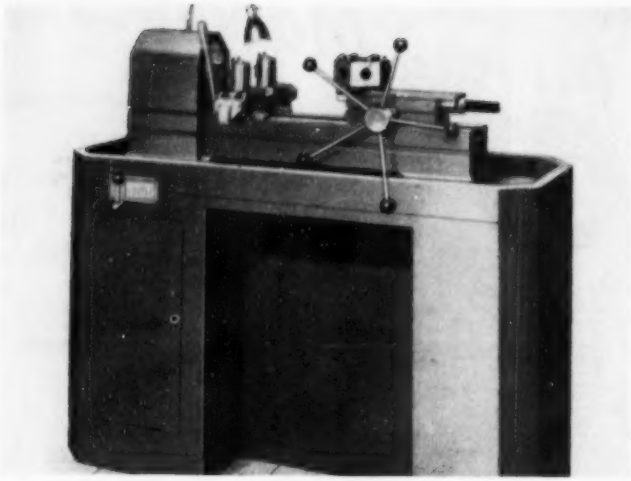


Globe Hand Screw Machine For Secondary Operations

Swing over bed	10 in.
Swing over cross slide	3¼ in.
Morse taper	No. 5
Hole through spindle	1 7/16 in.
Collet capacity, bar type	1 in.
Collet capacity, spindle nose type	1⅝ in.
Turret working stroke	5¼ in.

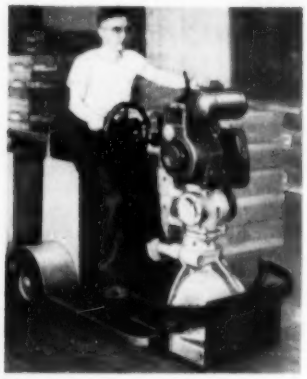
The Model-C hand screw machine is a high-speed machine, designed primarily for secondary operations.

Sealed-in-head, tapered roller bearings are used, assuring accuracy at both high and low speeds. The 40 ¼-in.-long bed is cast in one piece of high-chrome iron. Ways are 6-in. wide and are hardened and ground. Length of bed to headstock is 31½ in., and length of working area from spindle nose to turret face is 18⅞ in.

Drive is through a four-position quick-change gear box, employing dual V-belts running to two-step cone pulleys. This reduces slippage to a minimum at both high and low speeds. Through use of a 2-speed, reversible, 1-hp 1800-900-rpm motor located in base of pedestal, 8 speeds are available without belt change, and 16 speeds with only one belt change. Speeds are from 184 to 3796 rpm. Motor is instantly reversing. The hex-head turret is self-indexing.

The rack and pinion cross-slides have adjustable, double, steel toolposts. Tapered wedges are used for cutter adjustments and adjustable stops.

Globe Heat-Seal, Inc., Machine Tool Div., 5380 Robertson Blvd., Los Angeles 34, Calif.



Tractor Model Added To Truck-Man Line

Designated the Truc-Tor Model DR, this tractor is capable of hauling cargo trains of up to 13 times its own weight on dry level concrete and is the most recent addition to the Truck-Man line of trucks.

The heavy-duty air cooled engine of 5.8 hp is said to operate an 8-hr shift on approximately one gallon of gasoline. The unit, available in 4 models, is equipped with heavy-duty industrial pneumatic tires all around, assuring an easy ride. The power turret revolves 360°.

Truck-Man Div., The Knickerbocker Co., 537 Liberty St., Jackson, Mich.

A self-dumping trailer with a 1½-cu-yd capacity has been designed for 2-way use — pulling by hand, lifting and transporting by fork-lift truck, and towing singly or in train by industrial tractor. Conveniently sized for handling by one man, it features a sturdy tongue for manual and tractor handling. It is made of heavy-gage steel of all-welded construction, and is equipped with roller bearings and solid rubber tires. For maneuverability two of the wheels are castered. Balance of the hopper is such that when the safety catch is released the load is emptied, after which the hopper automatically returns to the loading position, re-engaging the safety catch.

Phillips Mine & Mill Supply Co., 2322 Jane St., Pittsburgh 5, Pa.

Portable Circuit Extension For Power, Light, or Heat

Known as NE Rolla-Duct, the unit provides a power and light head, a lighting head with four sockets, or a four-socket infra-red spreader. The carriage is mounted on a light all-steel tubular frame, the strip carrying sockets and outlets is mounted on a ball-and-socket assembly that may be locked in any desired position, vertical or horizontal.

The vertical strip which is fully grounded incorporates the circuit breaker for full worker protection, and may be raised to a height of 5½ ft, or when the carriage is collaped, may be rolled under a job, furnishing power and light at the point desired.

The carriage-mounted units carry an approved rating for 20-amp loads for 115- or 120-v operation and are designed as portable branch-circuit extensions that can increase the surface area of permanent electric outlets to a radius of 20 ft or more.

National Electric Products Corp., Pittsburgh 19, Pa.

Most popular 1952 models!

This year, three out of four cars on U.S. roads will be old models!

39% will be three to nine years old—their major repair age. No wonder motor experts say this is the year of repair!

To thousands of auto service dealers, hundreds of miles from factories and parts depots, this great demand for repair parts will pose a problem.

That's why, in sales meetings with dealers, motor car companies advise: "For faster turnover, lower inventory, more good-will; order repair parts via . . . Air Express!"

Air Express speed cuts days from repair time, builds dollar business at a cost of pennies. Whatever your need, you can profit from regular use of Air Express. Here's why:

IT'S FASTEST—Air Express gets *top priority* of all commercial shipping services—gives the fastest, most complete door-to-door pickup and delivery service in all cities and principal towns at *no extra cost*.

IT'S DEPENDABLE—Air Express provides one-carrier responsibility all the way and gets a *receipt upon delivery*.

IT'S PROFITABLE—Air Express service costs less than you think, gives you many profit-making opportunities.

New parcel post regulations affect you? Call your local agent of Air Express Division, Railway Express Agency.

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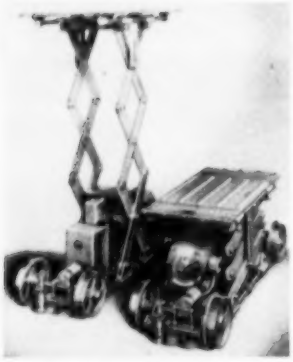


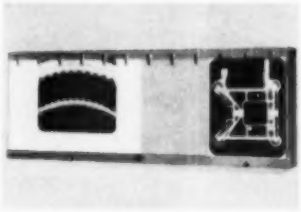
Lifting Device Aids In Material Handling

Called Portelvators, these special material-handling devices operate on track which skirts storage cells and processing stations. The units are moved manually from station to station and are elevated electrically.

Specifications include the following: scissor-lift mechanism operated by 1-hp elevator motor through standard Portelvator worm, worm-gear, and screw-power transmission; motor is actuated through foot control from either end of table; electrical controls include gear-driven limit switch and reversing magnetic starter.

Table size is 24 x 36 in. Lift is from 24 to 64 in. above floor level. Load capacity is 600 lb. Lift rate is 40 fpm.

The Hamilton Tool Co., Hamilton, Ohio



X-Ray Film Viewer Available From General Electric

A 4-in-1 Circline illuminator which can be wall-mounted, wall-recessed, or set up on a mobile stand is now available from GE's X-ray Dept.

Four 14x17 in. or smaller X-ray films may be viewed side-by-side on the unit, dimensions of which are 57-in. wide x 20½-in. high x 7-in. deep. Across the full 4-panel length is a 56-in. sheet of Plexiglas to diffuse the light, covered by a double-strength sheet of protective clear glass.

For easy servicing the unit can be opened from the front. The mobile stand on which the illuminator may be mounted is equipped with a drawer in which one may place rulers, protractors and other paraphernalia. Drip trays may be fastened to the panel.

The unit is said to be ideal for viewing stereoscopic films, using a GE hand stereoscope.

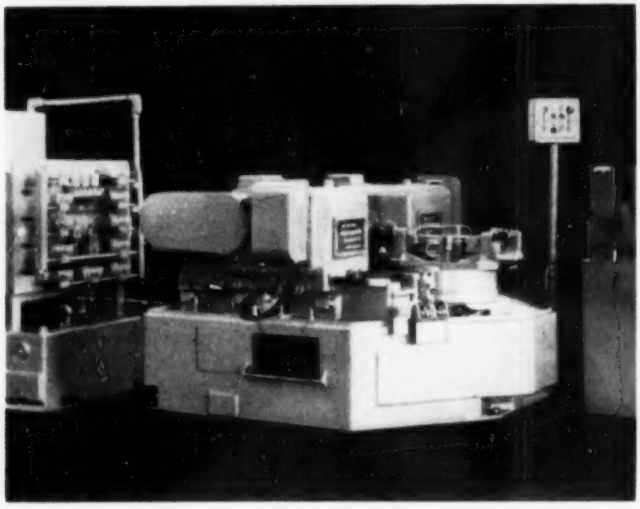
X-ray Dept., General Electric Co., Milwaukee, Wis.

Air-Operated Collet Holder Permits Multiple Installation

An addition to the line of the Modernair air-operated production devices is a collet-holding fixture of compact size to permit multiple installation on production indexing tables or where previously rapid positioning of small parts has been impossible.

The fixture uses standard shop collets 1A and 3C styles up to ½-in. capacity. The unique design of the unit permits handling of long pieces through the entire fixture without interference to capacity. Over-all size is 2 11/16-in. high by 3 9/16-in. base.

Modernair Corp., San Leandro, Calif.



WEIGHT-BALANCE MILLING MACHINE removes enough metal from each end of an automotive connecting rod to keep the balance of the rod within 2 grams. It is made up of a reciprocating table, rotating 180°, carrying two sets of work-holding fixtures, two opposed special quill-milling heads mounted on hardened ways, and a Toledo Scale unit housed in a floor-mounted cabinet, positioned at right angles to the machine, within easy reach of the operator. Operation cycle is completely automatic; production rate of the machine is up to 320 pieces per hr. — *The Motch & Merryweather Machinery Co., Cleveland, Ohio*

Diamond cutters for use in marking hardened and ground machine-tool parts and dies are made with diamonds faceted to a sharp point. Used in an engraving machine spindle, the cutters will make a clear mark to a depth up to 0.005 in., depending on the material and degree of hardness. Furnished in straight shank and tapered shank, these cutters can be used in any engraving or routing machine adaptable to these types.

Industrial Branch, H. P. Preis Engraving Machine Co., Hillside, N. J.

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MACHINES AND ATTACHMENTS

1 GRINDING METHODS—*The Carborundum Co., Niagara Falls, N. Y.* Set of 32, 4-page illustrated bulletins on better grinding methods. Contains technical data, specifications, etc. on all phases of grinding applications.

2 SPECIAL MACHINES — *Krueger-Barnes Corp., Detroit 11, Mich.* 14-page illustrated catalog of special machines. Contains descriptions of construction, applications and capacities. Also describes automatic feeding units.

3 BALING PRESSES—*Harris Foundry & Machine Co., Cordele, Ga.* 6-page illustrated folder of a baling press for nonferrous scrap. Describes construction, operation and special features.

4 DIAL-ASSEMBLY PRESS — *Precision Detroit Co., Detroit 14, Mich.* 12-page illustrated brochure on an automatic dial-assembly press. Gives complete specifications of press and accessories, including index table, heads, etc.

5 CONTOUR MACHINE—*DoAll Co., Des Plaines, Ill.* 16-page illustrated catalog on the advantages and manufacturing short-cuts possible by contour machining with hand-tool machines.

6 HOT-FORMING MACHINE — *Tube Reducing Corp., Wallington, N. J.* 4-page illustrated folder describes the advantages of hot forming, complex finished parts and describes the machine and its operations.

TOOLS AND ACCESSORIES

7 FLOW METERS—*The Bristol Co., Waterbury, 20, Conn.* 40-page illustrated bulletin describing a line of flow meters for recording, integrating, indicating, automatic controlling, and telemetering the flow of steam, water, air, gas and other fluids. Contains technical charts and describes applications.

8 GAGE BLOCKS—*Webber Gage Co., Cleveland 11, Ohio.* 34-page illustrated thumb-indexed bulletin describing a complete line of gage blocks and their method of manufacture, specifications, types and accuracy. Includes accessories and price lists.

9 CENTRALIZED LUBRICATION—*Farval Corp., Cleveland 4, Ohio.* 16-page illustrated bulletin of applications for centralized lubrication. Gives installation data and shows advantages with typical installations.

10 LIQUID BLENDING—*Bowser, Inc. Fort Wayne, Ind.* 12-page illustrated folder describes construction, operation, flexibility, and application of system for accurately blending two or more liquids in increments as low as 1/20%.

11 CARBIDE TOOLS—*Newcomer Carbide Tools Div., Greenleaf Corp., Pittsburgh 51, Pa.* 16-page illustrated catalog listing a line of standard and special cemented-tungsten carbides. Provides information on blanks, tools, clamp tools, carbide-milling data, cutting and grinding data, prices, and other information.

12 JIG & FIXTURE COMPONENTS —*Jergens Tool Specialty Co., 715 E. 169rd St., Cleveland, 10, Ohio.* Illustrated catalog describes more than 875 component parts in a line of jig and fixture components.

13 AUTOMATIC ROLL MAKER—*New Method Steel Stamps, Inc., Detroit 7, Mich.* 4-page illustrated folder describing an improved automatic roll marker for screw machines. Includes dimensional data, operation, setup, applications and advantages.

14 LAPPING COMPOUNDS — *Penn Scientific Products Co., Philadelphia 24, Pa.* Group of three, 4-page illustrated bulletins on lapping compounds for diamond wheels, describes applicators, with uses and procedures.

15 MEASURING GAGES—*F. W. Dwyer Mfg. Co., Chicago 18, Ill.* 12-page illustrated catalog describing line of precision instruments. Covers portable and stationary gages for measuring positive or differential pressure, vacuum, velocity, flow or temperature of gases. Includes applications, ranges and capacities of various models.

16 TOOLPOST TURRETS — *Royal Products, Minonk, N. Y.* Technical data bulletin on line of tool post turrets. Covers construction, application, sizes, and includes simplified charts for ordering.

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FYI

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HEAT-TREATING AND WELDING

17 THERMOHMS—*Leeds & Northrup Co., Philadelphia 44, Pa.* 96-page illustrated catalog and buyer's guide on a line of general-purpose and specialized thermohms (resistance thermometers) for industrial and laboratory applications.

18 STUD WELDING — *Stud Welding Div., KSM Products, Inc., Merchantsville, N. J.* Illustrated handbook of convenience reference data on maintenance of stud-welding equipment. Text explains aspects of maintenance against a background of specific components and problems.

19 WELDING STEEL CASTINGS—*Tempil Corp., New York 11, N. Y.* 40-page illustrated booklet of recommended practices for the welding of steel castings. Originally published by the Steel Founders' Society of America, it contains complete information on the subject. Use company letterhead.

20 ARC-WELDING ACCESSORIES—*General Electric Co., Schenectady 5, N. Y.* 8-page illustrated bulletin describes recommended protective clothing, helmets and glass, brushes, carriers, chipping hammers and other arc-welding accessories.

21 COMBUSTION EQUIPMENT — *C. M. Kemp Mfg. Co., Baltimore, Md.* 12-page illustrated catalog describing line of combustion equipment. It covers the basic principle involved and the operation of Kemp industrial carburetor. Includes specifications of equipment and accessories.

22 AIROMATIC WELDING—*Air Reduction Co. Inc., New York 17, N. Y.* Group of three reprints of articles on airomatic welding, including: "Welding of Austenitic Stainless Steels," a 16-page article; "Welding Refinery Components and Pressure Vessels," and "Inert-Gas-Shielded Metal-Arc Welding of Magnesium."

23 WELDING TORCH—*National Welding Equipment Co., San Francisco 5, Calif.* 16-page illustrated brochure on a line of welding torches and accessories. Gives construction features, specifications, applications and capacities.

24 INDUCTION FURNACES—*Laboratory Equipment Corp., St. Joseph, Mich.* 12-page illustrated bulletin describing new model induction furnaces for carbon and sulphur analyses. Gives construction features, applications and technical data.

PLANT-SERVICE EQUIPMENT

25 INDUSTRIAL FURNACES—*Westinghouse Electric Corp., Pittsburgh 30, Pa.* 36-page illustrated booklet describing 12 different types of industrial furnaces, both gas and electric, and outlines their chief field of application.

26 BELT DRIVES—*E. F. Houghton & Co., Philadelphia 33, Pa.* 40-page illustrated booklet of tables for selecting a given belt drive show proper size pulleys, best motor base, right width and thickness of belt for load. Includes handy formulas.

27 LIGHTING MAINTENANCE—*Sylvania Electric Products, Inc., Salem, Mass.* 12-page illustrated bulletin outlines an 8-step program of planned fluorescent lighting maintenance, stressing the advantages of planned group replacement of lamps.

28 NOISE ELIMINATION—*Industrial Acoustics Co., New York 54, N. Y.* Illustrated pamphlet describes the principles of noise measurement and how the noises are related to the human ear. Discusses how to eliminate objectionable sounds in industry.

29 HYDRAULIC-LIFT TRUCKS — *The Raymond Corp., Greene, N. Y.* 4-page illustrated folder describes the company's complete line of hydraulic lift trucks. Complete specifications and explanation of features of each model are given.

30 BATTERY CHARGERS — *Electric Products Co., Cleveland 12, Ohio.* 4-page illustrated technical bulletin describes a full line of single-circuit motor-generator battery chargers for industrial batteries. A simplified listing makes for easy selection.

31 PROTECTIVE PAINT — *The Corrosite Corp., New York 17, N. Y.* 8-page illustrated bulletin describes the characteristics, applications and methods of use of a tough corrosion-resistant protective-plastic paint called Corrosite.

32 DUST COLLECTORS — *American Wheelabrator & Equipment Corp., Mishawaka, Ind.* 96-page illustrated catalog, "Dust and Fume Control," describes the various sizes and models of dust tube collectors and the advantages to be gained from cloth filtration.

33 TEMPERATURE CONTROL—*Automatic Devices Co. Inc., Western Springs, Ill.* 4-page illustrated bulletin describes the Weather-Flo, an indoor-outdoor temperature control. All details of construction and operation of this control are given. Includes installation sketches.

34 WHITEPRINTING OUTFITS — *Peck & Harvey, Chicago 45, Ill.* 4-page bulletin describes a Spee-Dee whiteprinting outfit for use in plants and offices. Covers how the whiteprinting process works and includes suggestions on printing and developing.

PARTS AND MATERIALS

35 ELECTRICAL EQUIPMENT — *Line Material Co., Div., McGraw Electric Co., Milwaukee 1, Wis.* Group of 13 illustrated bulletins and a general catalog on a complete line of electrical equipment, parts and accessories.

36 MAGNETIC MEASURING — *Meter and Instrument Dept., General Electric Co., Schenectady 5, N. Y.* 12-page illustrated bulletin describes instruments for the proper measuring of magnetic properties such as flux density, flux direction, and total flux.

37 MACHINERY PARTS—*Haynes Stellite Co., a Division of Union Carbide & Carbon Corp., New York 17, N. Y.* 24-page illustrated booklet, on a wide variety of cast-and wrought-alloy steel parts, now being used in many industries to solve abrasion, corrosion and high-temperature problems.

38 BEARING SELECTION — *McGill Manufacturing Co., Inc., Valparaiso, Ind.* 136-page illustrated catalog is a comprehensive guide to bearing selection. It contains such practical information as discussion of bearing-load computation and charts of load formulas.

39 STROBOSCOPES — *General Radio Co., Cambridge 39, Mass.* 8-page illustrated bulletin describes the stroboscope and explains how it works, together with specific applications of different instruments.

Reader Service Department
American Machinist
330 W. 42nd St.
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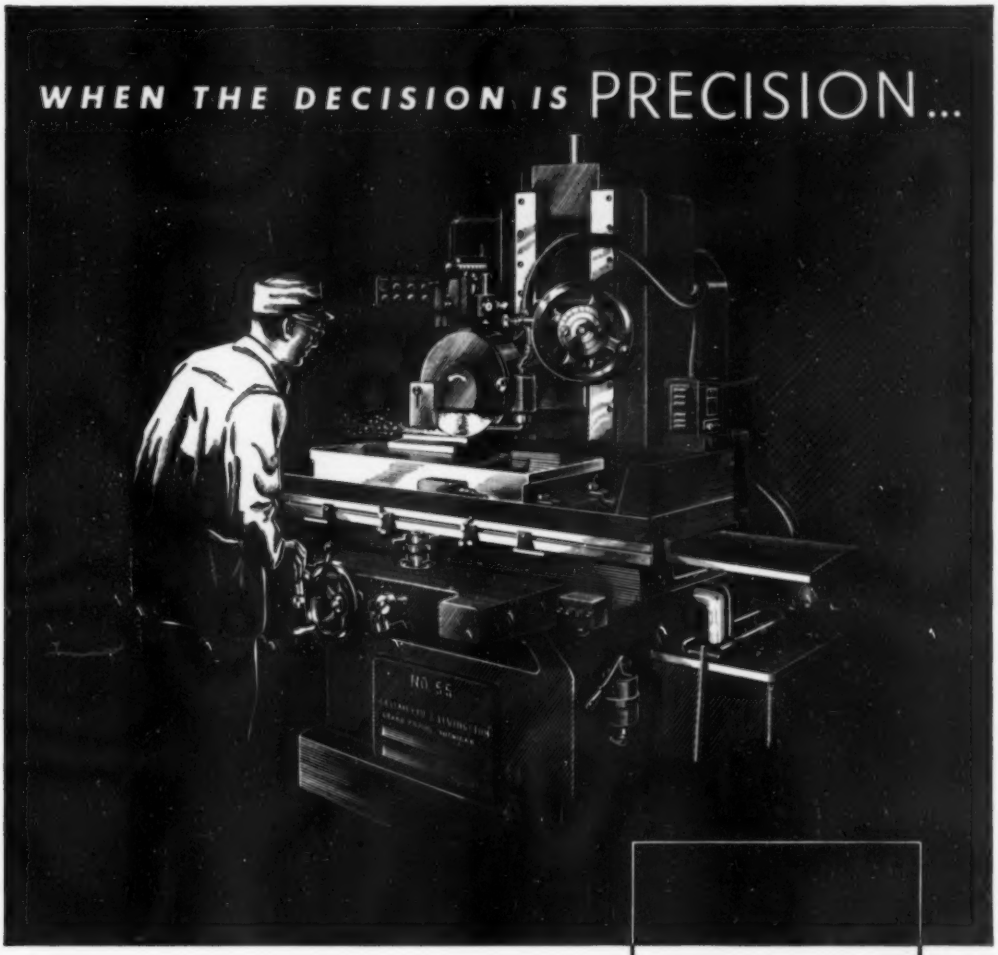
WHEN THE DECISION IS PRECISION...



Where extreme tolerances are not required, the choice of any particular grinding machine may not be too important. But, where absolute precision is demanded, the choice is usually *Grand Rapids.*

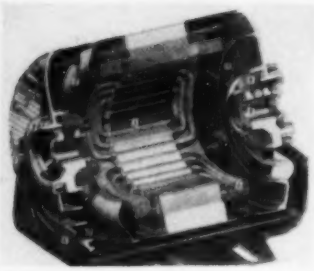
Defense orders make it impossible to fill orders as quickly as we desire—but we know our customers can appreciate the reasons for delay. As always we'll do our best to serve you.

GALLMEYER & LIVINGSTON CO.
330 Straight Ave., Grand Rapids, Mich.

Grand Rapids Grinders

—World's finest

GALLMEYER & LIVINGSTON



G.E. Fractional-HP Motors Weigh 51% Less Per Horsepower

Designated as Form G, the new motor weighs as much as 51% less per hp than the model it replaces, and is considerably less bulky. In addition, its versatility has been broadened, and appearance modernized.

The motors are available in open dripproof, and totally enclosed fan-cooled models in Types K (polyphase), KC (capacitor start), KH (split phase), and KCP (permanent split capacitor).

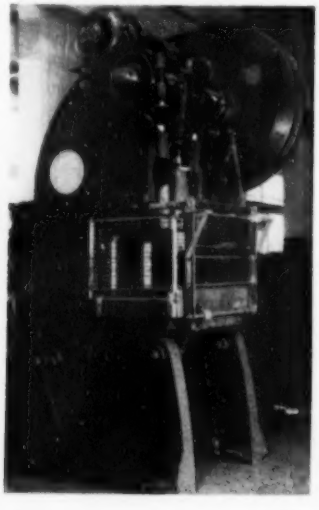
No cellulose or other natural insulating materials have been used. For sheet-type insulation—that is, slot liners and phase insulation—nylon, combined with Formex insulated wire and Glyptal varnish, provides a tough, heat-stabilized, and extremely moisture-resitant material.

The Form-G motor is claimed to be the first general-purpose, sleeve-bearing motor designed for all-angle operation. It is capable of handling normal thrust loads in any direction. This feature is possible because of a sleeve and thrust-bearing design in which provision is made for complete oil retention and recirculation regardless of the position of the bearing or the direction of the load.

Features which have reduced size and weight include:

1. A steel stator shell which is light-weight with a phosphatized surface for corrosion protection. 2. Flat-disk end shields of die-cast aluminum which are ribbed and reinforced for extra strength. 3. A stator core of welded construction which is kept slightly larger than the inside diameter of the stator shell. In assembly, therefore, the shell is expanded slightly within its elastic limits to receive the core.

General Electric Co., Schenectady 5, N. Y.



Open-Gap Presses Designed to Reduce Die Wear

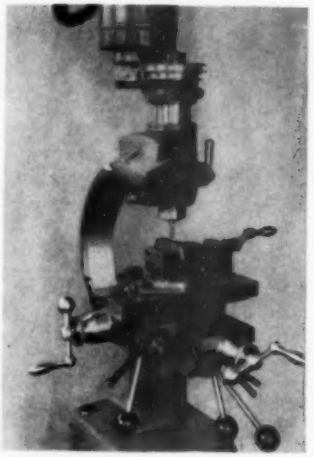
The objective of this press is to reduce the maintenance cost of dies, particularly of complicated and expensive types. This has been accomplished by making two constructional modifications in the standard open-gap design:

1. By improving the means of guiding the ram. Circular bar slides have been substituted for the ordinary V-slides. The bars are of hardened steel, ground to fine limits. Large bronze bushings are fitted in the slide for contact with the circular bars.

2. By causing the ram face in the surface of the bed or table to remain parallel with each other in spite of frame deflection when the load is applied. There is no offset in the ram construction, the pressure is applied in one straight line. The ejector in the ram is adjusted by a single screw. Drilled projections for holding rectangular dies are used in addition to the punch shank.

Specifications are: speed up to 250 strokes per min.; single stroke or continuous operation; area of bolster, 6x9¼ in.; opening in bed, 5½x 3½ in.; depth of throat, 3⅜ in.; and special strokes of 1¼ and 1½ in. furnished. Tonnages available are 35-, 45-, 60-, 75- and 95-ton. Selling agent is:

Hercules Presses Ltd., Box 96, Postal Station K, Toronto, Ont., Canada



Half-Circle Column Makes German Miller Universal

A protractor-shaped half circle on the Nothelfer (German-made) milling machine guides the head (motor, step-pulley and milling spindle) around a 90° arc. The head can be locked on the protractor guides in any desired position from vertical to horizontal.

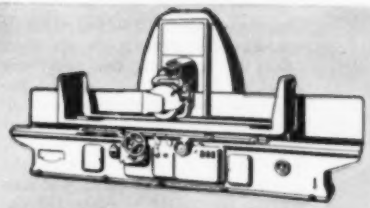
The 3½x8⅝-in. table is moveable in three directions by either feed-screw and crank or by quick-action levers. Spindle speeds are up to 4000 rpm.

The unit can be used for milling, as a drill press, grinding machine, or small lathe. When used as a lathe or grinder, the head is usually set in a horizontal position. The tool-post is fixed in a table T-slot and a collet chuck or lathe chuck is put on the spindle. The spindle center hole will take material up to approximately 0.4 in. dia. The table then provides for tool movements. Imported by:

Eric R. Bachman, 27-11 51st Ave., Long Island City 1, N. Y.

MATTISON GRINDERS

If its a Flat Surface to Grind
There's a Mattison to Grind it.



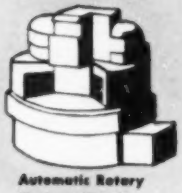
Precision Surface Grinders
Horizontal Spindle

Disc Grinders,
Double Spindle Type

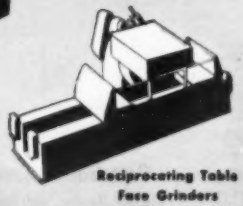
Vertical Spindle
Disc Grinders

Plane Grinders,
Rotary Table Type

Rotary Table
Surface Grinders

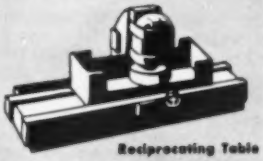


Automatic Rotary
Surface Grinders



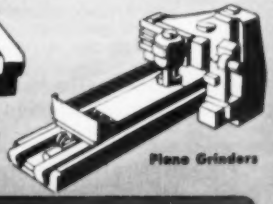
Reciprocating Table
Face Grinders

Disc Grinders,
Single Spindle Type



Reciprocating Table
Surface Grinders
Vertical Spindle

Face Grinders,
Traveling Wheel



Plane Grinders

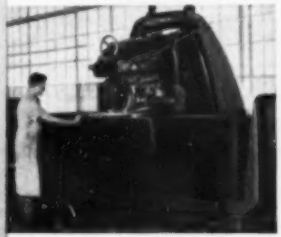
● The comprehensive "Mattison Line" of grinders enables Mattison Machine Works to work with you on all your surface, face and disc grinding problems. These machines are made in various types to handle a wide range of work and enables our engineers to recommend the particular type of grinder that will give you maximum accuracy, production and economy.

For any flat grinding, ask for our recommendations on the proper method and machine for your job. No obligation, of course.

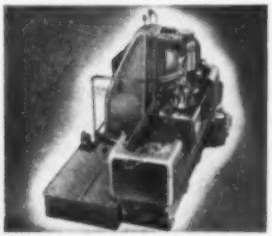
For catalogs on any of the types shown or if you would like a copy of the general bulletin, let us know and we'll gladly send them to you.

200 Transmission Case surfaces ground per hour on Mattison (Hanchett Type) Rotary Automatic Grinder. A special 8-station mechanical fixture permits one operator to grind each end of this large 35 lb. casting, flat and parallel. Stock removal .060".

Grinding cast-iron cams — 8" diameter, 1½" thick — stock removal, each side .030". Production, 120 surfaces per hour on Mattison (Hanchett Type) Rotary Surface Grinder.



2½ ton machine-bed ground in 80% less time on Mattison Precision Surface Grinder than required by former method, hand scraping.



The No. 24 Duplex is equipped with two rotary tables. Where loading time is about the same as grinding time this machine can practically double production.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

Jack lift truck is part of the NesTier line of accessories. It will hold 20 tiered or 20 nested hoppers

Conveyor tray is for overhead monorail systems used in order makeup. It holds nine tiered NesTiers

Line of Accessories and Parts for NesTier Materials-Handling System

Basis of this system are two hoppers, called NesTiers. Model 175 is 17½ in. long, 9¼ in. wide, and has an inside depth of 5½ in., Model 220 is 22⅝ in. long, 12⅛ in. wide, and has an inside depth of 7¾ in. Each NesTier can be nested or tiered. Completely open at the top, they can be used with two operators working side by side. When tiered, each hopper can be loaded from one end as parts are withdrawn from the other, thus eliminating racks. Folding bales are located at either end. These form the supports when the boxes are used in the tiered position. They fold inward to fit the steps on the bottom of each box. The accessories for the hoppers are as follows:

A single-unit dolly is designed to convey loaded hoppers from machine to machine along the production line. Made of wood with four casters, it will hold six hoppers tiered or 24 nested.

A caster truck is made of heavy-gage structural steel and it will hold four stacks of hoppers—a total of 24 in a tiered postion or 144 nested units.

A rack can be used by hand-powered or regular fork-lift trucks and hand-operated or platform lift trucks. Made of structural steel, three racks can be safely tiered on a fork lift truck. Each rack will hold 24 hoppers when tiered, or 144 in nested position.

A jack-lift truck will drop the twin hoppers for stationary use at machines or in stockrooms. It will hold 20 tiered or 120 nested.

A conveyor tray is designed for overhead monorail systems used in order make-up systems. The tray can be used on either hand-operated or motorized monorails. It will hold 9 tiered NesTiers.

A two-shelf maintenance wagon can be used to supply needed repair parts from the stockroom to the job and return. Parts can be kept neatly in hoppers and the twin hoppers left on the wagon.

Charles William Doepke Mfg. Co., Rossmoyne, Ohio

Gold Master Blocks Serve As Reference of Surface Roughness

A 7-year cooperative engineering project, with research and development costs borne by Chrysler and General Motors, has perfected for all industry a set of precision reference specimens of surface roughness in pure-gold master blocks. As a result, uniform precision in surface roughness measurement, accurate to one millionth of an inch, will now be possible.

The standards defining the specimens have since been adopted by the SAE and American Standards Association and they are available to everyone. Reproduction of the master specimens will make it possible for anyone to calibrate his surface roughness measuring device by the same standards as the engineer who worked out the original specifications.

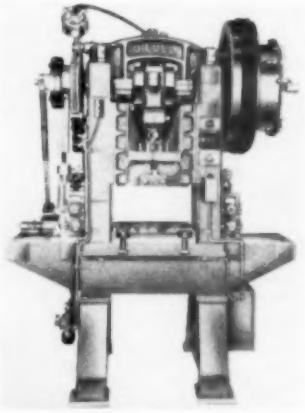
First replica blocks will be a combination of five so-called roughness values, the five most commonly used now in machining of parts surfaces. Other values will be prepared later.

The gold blocks provide constant roughness values. Thus engineers or machinists working with precision parts can compare the roughness value of the part with one of the specimen blocks and determine immediately whether the machine surface has a proper value.

Following the early work on the project at the University of Michigan Physics Dept., GM Research Laboratories developed a ruling machine capable of inscribing up to 10,000 lines to the inch in the gold master blocks. The method of calibrating these rulings was perfected by Chrysler Engineering Laboratories.

Replicas of the gold master specimens will be produced by:

The F. A. Ringler Co., Detroit, Mich.



Electrically Controlled Clutch And Brake on Automatic Press

Automatic press, known as the Diebel Di-Matic, can produce intricate piece parts from the most complicated progressive dies because of its extra rigidity.

Features include: four main crankshaft bronze bearings; an air-operated and electrically controlled friction clutch and brake; air ejector and cam; metered lubricating system; cylindrical slide 16 in. in diameter guided by adjustable retainers with 380 sq in. of contact area. Other features are a knock-out bar for compound dies; built-in scrap-cutter; 5-hp vari-drive motor; air-clamped roll feed, driven by rack and pinion, with Formsprag overrunning clutch equipped with double ball bearings; and spring and rubber shock mounts.

The electrical control circuit uses a safety shutoff device, giving maximum protection for press and die.

Die Machine Corp., 2711 W. Irving Park Road, Chicago 18, Ill.

2 SPINDLES OR 200—WORK OUT ANY SET-UP TO SUIT YOUR OWN NEED with DELTA DRILL PRESSES

For simultaneous performance of one operation or sequence-performance of such operations as drilling, countersinking and boring, Delta drill presses have the flexibility that makes any set-up not merely possible, but easy.

Low in cost, easy to maintain, readily portable, these drill presses are good examples of fine engineering, rugged construction and compact design—an ideal combination that has made them exceedingly popular.

Patented spindle drive and mounting assures accuracy—and many useful attachments make possible an unusually wide variety of machining operations.

Two models: 14 inch and 17 inch.

DELTA POWER TOOLS Another Rockwell Product

DESIGN YOUR OWN MULTIPLE DRILL SET-UP WITH DELTA SECTIONAL TABLES

Sectional tables consist of center sections to be bolted together between end sections, forming a smooth, sturdy working surface ideal for easy movement of the work through a series of operations.

There's a Delta Power Tool for Your Job-
WOOD OR METAL
53 MACHINES 246 MODELS
More than 1300 Accessories

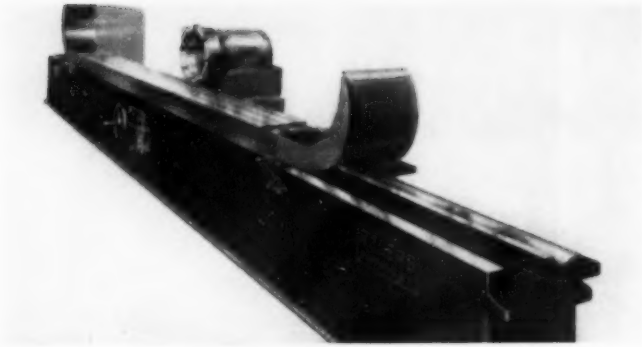
For Delta Dealers, see your Classified Phone Directory under "Tools"

MILWAUKEE

DELTA POWER TOOL DIVISION
Rockwell MANUFACTURING COMPANY
609 C East Vienna Avenue, Milwaukee 1, Wisconsin

☐ Please send new Delta AB-51 Catalog

Name_____ Position_____
Company_____
Address_____
City_____ Zone____ State_____



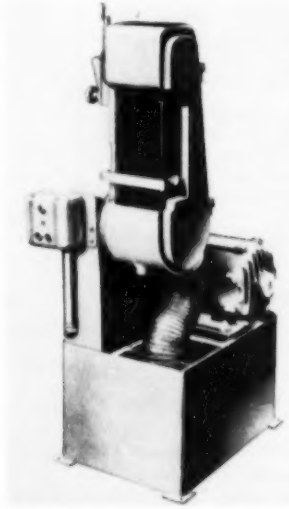
Face Grinder with Hydraulic Or Reversing Motor Drive

Three table-drives are available on this grinder. Constant- and variable-speed motor drives with table rates up to 100 fpm and a hydraulic drive with speeds up to 150 fpm.

Known as Series 250, there are six standard models (38, 60, 90, 120, 140, and 180 in.) with intermediate sizes available on special requests. Capacity varies with size; the 120, for example, will take work with dimensions of 20x20x120 in. Load weight may be up to 4000 lb.

All models are equipped with a separate 30-, 35-, or 40-hp heavy-duty grinding-head motor and a 26 in. or larger segmental grinding wheel for fast stock removal. All models have a combination of extra-wide V and flat ways machined into the base. Because of the reciprocating action of the table, the ways are self-aligning. All bearing surfaces are automatically force-lubricated.

Samuel C. Rogers & Co., 183-210 Dutton Ave., Buffalo 11, N. Y.



Belt Grinder Quickly Changed From Vertical to Horizontal

All-purpose belt grinder is adaptable to a wide range of operations—often handling jobs which previously had to run on wider and more expensive belts. Equipped with a standard 6-in. belt which runs over 12½-in platen, the grinder is an economical size for medium work.

Designated Model 506, it is used for free-hand applications on work which require flat surfaces, deburring, squaring, chamfering, rounding, and polishing.

It can be changed over from vertical to horizontal operation by simply loosening two hex nuts. For smaller pieces, particularly for those having more length than thickness, the machine is usually set in its vertical position. The work is supported by a workrest and squared with the platen.

For machining larger or heavier pieces, the work is usually set in its horizontal position. The operator can then "iron" the work back and forth. The workrest resists the tendency of the belt to pull the piece along. By "rolling" the piece across the belt surface, a cross-cross rather than a straight line finish may be obtained.

The grinder is equipped with two-speed pulleys for 3300 and 4000 sfpm. The pulleys are easily changed to the proper surfacing speed for metal, wood, or glass. An optional set of pulleys for 2400 and 5500 sfpm is also available at no extra cost.

The cast-iron drive pulley is 8 in. in dia and 6¼ in. wide and the idler pulley, which is cast aluminum, is 5 in. dia and 6¼ in. wide. Both pulleys are balanced and run on heavy-duty ballbearings which are sealed to exclude dirt and coolant.

A pretensioning device eliminates need for releasing the entire idler tension each time the belt is changed. An adjustment knob provides speedy belt alignment.

Another model, with a built-in coolant system, may be used for grinding materials requiring a wet abrasive belt. The 24-gal. tank has a large chip basket to facilitate clean out. The coolant runs downward to a large flexible dust tube and is filtered twice before re-entering the pump. A worktable is available as accessory equipment. It is 10 in. wide by 7 in. deep, adjustable to 45°. The table is slotted for a gage which is adjustable through 90°.

Porter-Cable Machine Co., Dept. PR-1, Syracuse 8, N. Y.

ELECTRO-HYDRAULIC CHECK BENCH tests the brake-light switch for a large automotive manufacturer. The four major requirements are: (1) 2500-psi hydraulic pressure applied to the switch as a pressure breakdown test and to assure seating of the metallic pressure-diaphragm. (2) 130-psi hydraulic pressure applied to determine that the switching element makes contact between 60 and 110 psi. (3) That the switch element during the test contact time carries the same amperage as two brake-light bulbs on 6-v battery circuit. (4) That the unit test ten parts per minute. — *J. N. Fouver Co., Inc., 49 West Hancock, Detroit, 1 Mich.*

One of the many types and sizes of McClintock pans

How McClintock pans are used in modern markets

SMOOTH way to do a SMOOTH JOB

McClintock Manufacturing Co. of Los Angeles manufactures an extensive line of metal platters and pans used by up-to-date markets for the display of meat. For space in the cabinets, the pans must be rectangular; for sanitary reasons they must be one-piece and perfectly smooth. And they can't cost too much, either.

In the picture you see how McClintock uses a Clearing hydraulic press in drawing these pans. Automatic sequence control simplifies operation and delivers maximum production. Cushion pressure is accurately regulated, and the result is a smooth piece smoothly produced every time.

Whether your metal forming problem is like this one, or entirely different, Clearing engineers can help you. Clearing makes both mechanical and hydraulic presses to fit virtually any production requirement.

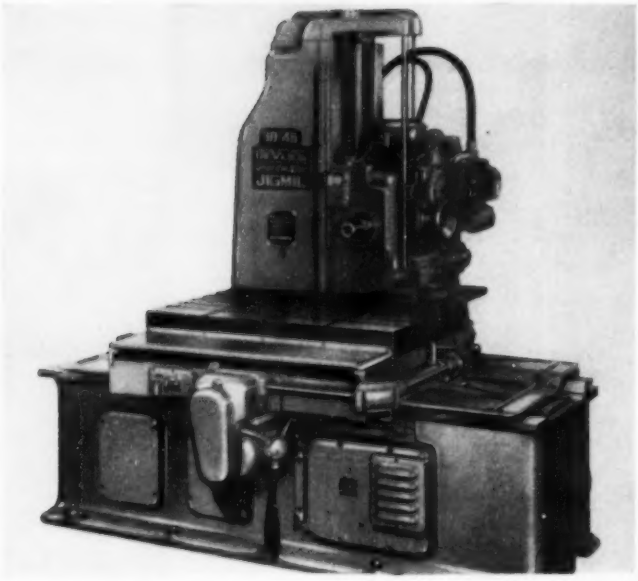
CLEARING MACHINE CORPORATION

6499 WEST 65TH STREET ★ CHICAGO 38, ILLINOIS

HAMILTON DIVISION, HAMILTON, OHIO

CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION



Automatic-Transmission Spindle Head On DeVlieg Boring Machine

DeVlieg Spiramatic Jigmil horizontal boring and milling machines have two new important developments:

1. Spindle head with automatic transmission
2. Automatic trip mechanism for spindle bar feed

The Spiramatic spindle head has single helical gears operating in constant mesh. Spindle speeds are preselected by rotating a dial to the desired speed, with the actual change made automatically by depressing a single pushbutton. The changes are made smoothly and without shock to the transmission, and can be operated with a spindle running in the foreward or reverse direction.

An automatic trip mechanism stops the bar feed at any predetermined point. This feature provides a means for accurately controlling the depth of bar feed when dealing with counterboring, facing, and backfacing operations. A combination of graduated dials and vernier scales are provided for establishing the depth of feed and the power feed is automatically stopped when the tool reaches the desired depth of cut. A rotating turret attachment with multiple stops and trip mechanism is available for production work involving multiple counterboring and facing operations to close limits.

Basic features which have long been incorporated in DeVlieg Jigmils are as follows: automatic setting of both table and spindle head and positioning of the machine slides in the horizontal and vertical planes performed automatically through a sequence electrical cycle.

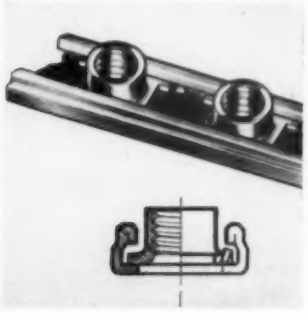
Jigmil Duplitrol system—a set of two simple Duplitrol bars is provided for each job; they serve as permanent spacing elements for duplicating the particular workpiece at any time.

Power tool lock mechanism—an electrically-operated device for locking and releasing the cutting tools. Machine spindle is hollow and carries a threaded draw bar which is rotated by power. The spindle nose is furnished with standard milling machine non-stick taper, and the cutting tools are locked to release by power in response to a single pushbutton control.

Series B Spiramatic Jigmils are designed for operations ranging from tool and experimental work to the production of repetitive work without jigs. The Series 3B have 3-in.-diameter spindle bar, 48-in. vertical range, and 48-, 72-, or 96-in. horizontal range. The Series 4B have 4-in. diameter spindle bar, 48-in. vertical range, and 60-, 72-, 96-, or 120-in. horizontal range.

Series-C Jigmils are designed specifically for large-area flat work; such as textile- and printing-machine side frames, aircraft-wing assembly jigs, etc. The Series 3C have 3-in.-diameter spindle bar, 36-in. vertical range, and 72- or 96-in. horizontal range. Series 4C have 4-in.-diameter spindle bar, 48-in. vertical range, and 96- or 120-in. horizontal range.

DeVlieg Machine Co., 450 Fair Ave., Ferndale 20, Detroit, Mich.



Multiple Lock-Nut Fastener

Multiple lock-nut fastener, the Kaylock Gang Channel, is a small compact design that makes its application interchangeable with the standard type of anchor nut. Containing spring-steel lightweight lock nuts as inserts, this multiple nut fastener is reported to be narrower, lower, lighter and stronger than any similar product.

Made of 24-ST Alclad aluminum alloy to Army, Navy and Air Force specifications, the channel portion features a double-vertical wall, providing high push-out resistance, plus maximum rigidity, thereby requiring less riveting for attaching. Inserts used are the Kaylock spring-steel high-temperature self-locking nuts which cannot be damaged by cross threading. It is made in sizes ranging from 8-32 through ¼-28.

Kaylock Div., Kaynar Mfg. Co. Inc., 820 E. 16th St., Los Angeles, Calif.

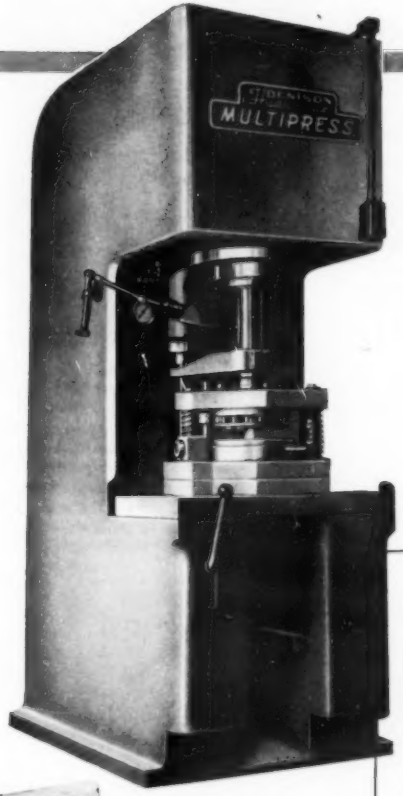
Low-cost work benches feature heavy rolled-steel frame construction; legs are tension bolted to frame to insure rigidity. Adjustable feet and a choice of two warp-proof tops, lacquered and waxed, oil and grease resistant in either hard-rock maple or pressed wood, both 1⅝ in. thick. The tables are available with or without steel drawers and all steel parts are furniture finished. The tables are available in two sizes 23 x 46½-in. top, 33½-in. high; 23 x 60-in. top, 33½-in. high.

Sturdi-Bilt Steel Products, Inc., 624 S. Michigan Ave., Chicago 5, Ill.

FOR FASTER PRODUCTION PLUS

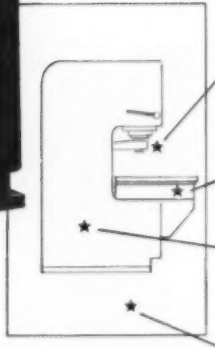
QUICK CONVERSION

standardize on MULTIPRESS®



Wide-range adjustability of action makes Multipress the quick, high-production answer to an amazing variety of manufacturing needs – ordnance jobs included. This easy adaptability pays a bonus *every time* you switch from one type of operation to another — now or later. You can convert *rapidly*, for fast production and better results, when you standardize on Multipress equipment. And *early deliveries* on most Multipress equipment give you another break on your production planning.

Here are some available Multipress features that bring you these profitable advantages:



1. FULLY ADJUSTABLE:
- Stroke Length
- Tonnage
- Ram Traverse Speed
- Pressing Speed
- Ram Dwell or Time Delay
- Ram Cycling (automatic)
  - Single or Sequence
  - Vibratory Ram Action

2. EASILY EQUIPPED WITH:
- Multipress Index Table Feed
- Multipress Dial Feed Tables
- Multipress Harmonic Stock Feed
- Hopper Feeds
- Standard Tooling Fixtures

3. WIDE RANGE OF SIZES
- 8 Frame Sizes
- 11 Tonnage Capacities
- Interchangeable Power Units, Cylinder Assemblies and Control Valves

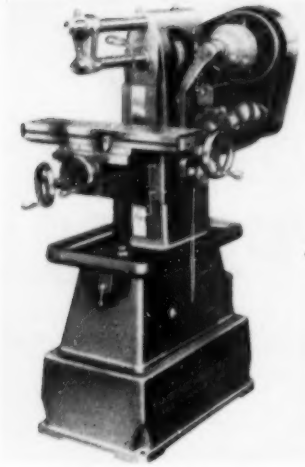
4. PLUS:
- Good Deliveries

1 to 50-ton capacities

WRITE TODAY: for full details on the versatile Multipress and its wide range of accessory equipment.

DENISON HydrOILics

The DENISON Engineering Company, 1164 Dublin Road, Columbus 16, Ohio

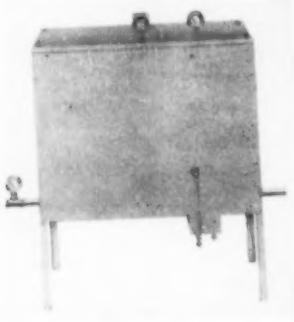


Diamond Milling Machine Has Automatic Kickoff on Power Feed

The Model 22M is claimed to have the rigidity, precision, and capacity of far larger machines. Longitudinal travel is 14 in., maximum vertical travel from center of spindle to table top is 15 in., and cross traverse is 5½ in. Table working surface is 5¾ x 24 in.

Offset handles provide for easy operation of the vertical heads. Spring-loaded dials are used in settings. Power feed has an automatic kick-off, and the motor drive design is arranged for standard Nematype motors. A full line of accessories and attachments is available.

Diamond Machine Tool Co., Los Angeles, Calif.



Water-Oil Separator for Industrial Oil Purification

The PurDry water-oil separator is said to eliminate the necessity for changing or discarding oil regardless of type contamination encountered. The unit is able to reduce the water content of oil to an insignificant trace, less than one-tenth of 1%. It performs a complete filtering service for removal of solid contamination, acids, and other sludge-forming products of oxidation as well as water separation. Continuous operation of the unit on by-pass circulation keeps the oil in safe operating condition at all times.

It performs water separation and filtering of solid contaminants continuously and automatically. Cleansing action of the filter and the purifier units permits delivery of thoroughly purified oil.

Honan-Crane Corp., 701 Indianapolis Ave., Lebanon, Ind.

Trim Coolant Prevents Gumming And Corrosion, Stops Bacteria

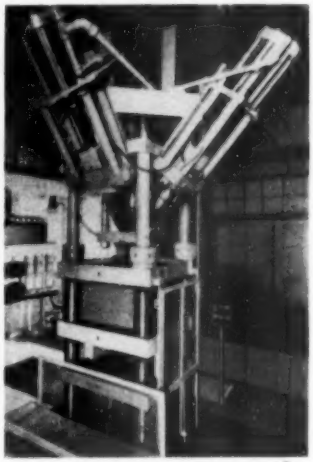
Trim is claimed to have solved the problems which accompany bacterial growth in water-base coolants—gumming, corrosion, and objectionable odors. In one application, the coolant wasn't changed for seven months. During that time the only operations necessary were chip removal and addition of more water-Trim make-up.

The coolant is claimed to be extra effective for cutting and grinding the newer jet engine alloys such as Inconel and heat-resistant stainless steels. One machine tool builder is using it for machining Titanium.

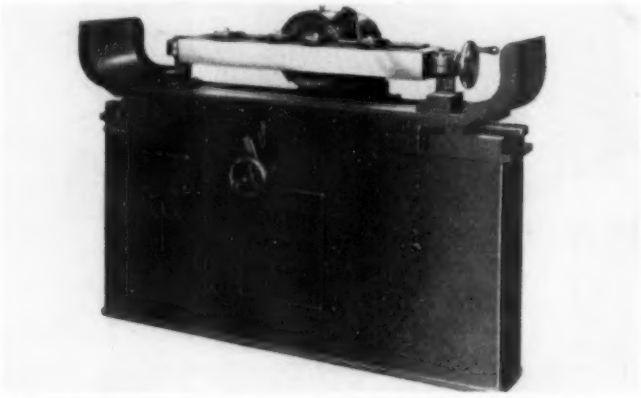
The lubrication laboratory of a large steel company tested Trim on the Timken lubricity machine, and they found it to have the highest lubricity of any water-base coolant previously tested—even higher than most oils.

Price in single-drum lots is $2.50 per gal., f.o.b. Toledo, Ohio.

Master Chemical Corp., 538 Erie St., Toledo 2, Ohio



GIANT VERTICAL MOLDING MACHINE is claimed to possess 25% more capacity than any plastic molding machine in existence. Four pre-plasticizing units preheat the material to give it greater flowing properties. This, together with 25% greater locking pressure on the dies, permit the molding of pieces in extra-large sizes. — *Worcester Moulded Plastics Co., Worcester, Mass.*



LIGHT-DUTY GRINDER combines speed and low-cost for grinding woodworking, paper cutting, and other straight knives. A separate reversing motor drives the reciprocating table assembly. A swivelling knife bar on heavy trunnions is fitted to the table. An index is included to allow for easy setup for bevel grinding to any desired angle. It is produced in four sizes—32-, 38-, 48-, and 60-in., and the stroke is adjustable to any length within these limits.—*Samuel C. Rogers & Co., 193-210 Dutton Ave., Buffalo 11, N. Y.*

Practical Assistance

Whether it's getting out of a fishing tackle tangle, or unsnarling a *cutting oil snag* on your production line . . . practical assistance, the kind that gets you off the hook fast, is the thing you look for most.

And ***PRACTICAL TECHNICAL ASSISTANCE*** is a Cities Service specialty.

Cities Service Lubrication Engineers can offer every machining operation practical assistance that will mean dollars, man-hours and equipment saved. These specialists recommend the most effective lubricating practices, and they offer the most complete line of quality cutting fluids.

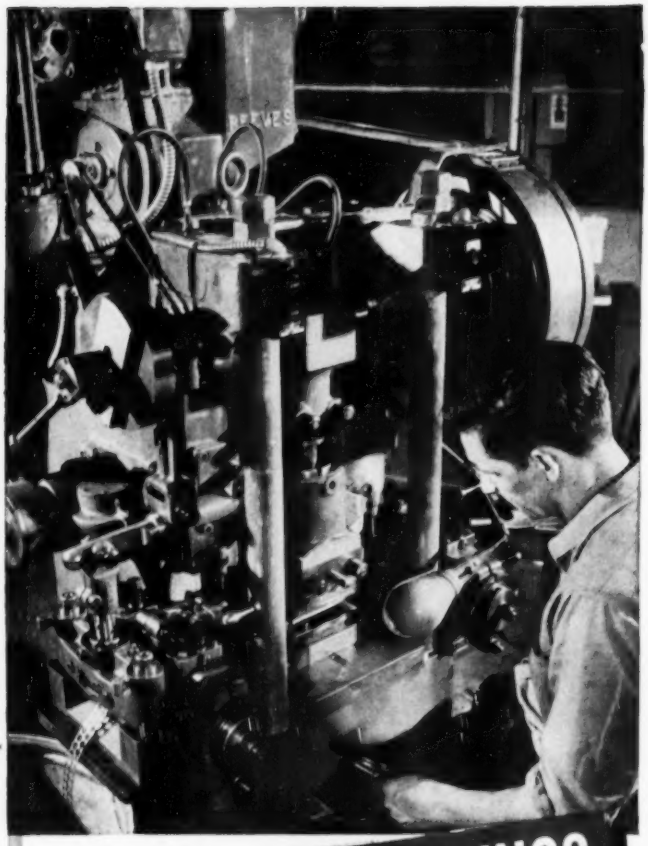
but check for yourself:

✔ Check the high quality of Cities Service cutting fluids. Check operations similar to yours, or better still, test them on the job.

✔ Check the *complete* Cities Service line as an ideal, single source for the correct cutting fluid for every need. Deliveries are quick, accurate and dependable.

✔ And finally, discuss your problems with a Cities Service Lubrication Engineer . . . he's probably solved many like them in manufacturing plants throughout the country. He wants to help you. He can help you. Write or phone CITIES SERVICE OIL COMPANY, Dept. C37X, Sixty Wall Tower, New York City 5 . . . or get in touch with the office nearest you.

CITIES SERVICE



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Manufacturers of the famous ***LAMINUM*** *shims that peel for adjustment*

ROUND TABLE *Discussion*

WHO SAYS HOW?

Do job instruction cards limit the skill and ingenuity of the workman? Do they bypass the foreman's prerogative of exact instruction? Our readers write of their experiences with these devices—

THIS IS ONE of the conflicts that will never be resolved, human nature being what it is, and part of the truth lies on each side of the line of battle. There definitely is something to be said for bonafide industrial engineers who come from the outside to look in and make a report, make up written instruction cards, or whatever. They are not afflicted with the nearsightedness which inevitably seems to lay hold of many of our best men.

The experience they have gleaned from many similar and dissimilar industrial layouts nearly always yields something that can profitably be applied in practically any plant of which they make a study. On the other hand, it is entirely possible for them not to obtain a full insight into some of the more peculiar problems with which a given organization is faced, and as Ed says, there is a strong possibility of them fouling such things up.

Ed doesn't like the idea of his background being bypassed. This is probably personal pique in some degree, but it also has a sound foundation in some degree. It is to be regretted that personal pique is allowed to rule the situation in too many places and cases. Just let an outside man of any caliber try to show how things can be done better. While he is actually on the job and making his study, he will usually be treated well, because the watchful eyes of higher management are known to be focussed on the situation. After he has gone, and his report is in hand, however, watch the boys gang up and go over the report with a fine-tooth comb for "bugs". Watch them rejoice over any they find, and study to show them up in the worst possible light.

This is as true in the engineering department as it is in the shop. Let an outside engineer come along with the best idea in the world touching improvement of a given product. The chief engineer on the job will reason something like this. "I've been here for a long while, and here comes

where power is part of the product,

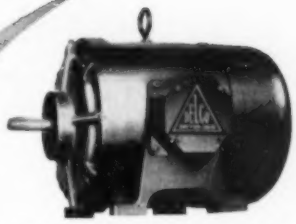
you're right with a

DELCO

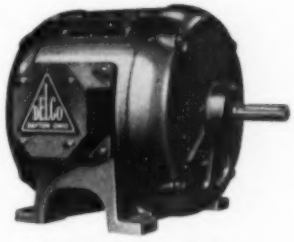
When you need motors—to serve as a *part* of your product or to help you *make* your product—look to Delco for the motors that will serve you best.

Delco produces motors for practically every known purpose . . . and each Delco motor is *engineered* for the kind of work it has to do. It's made of the finest materials, and constructed to stand up longer under the roughest conditions.

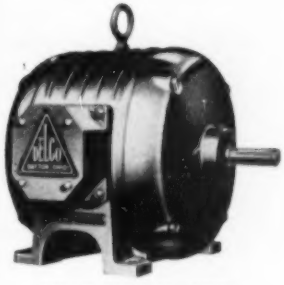
So check on Delco. You'll find Delco motors fit your needs, and that Delco always delivers on time. For complete details, write to Delco Products, Dayton, Ohio, or call the nearest sales office listed below.



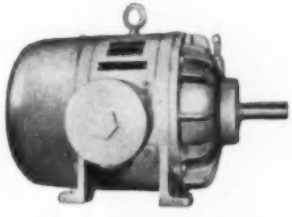
TOTALLY ENCLOSED FAN-COOLED MOTOR



OPEN BALL-BEARING MOTOR



TOTALLY ENCLOSED MOTOR



EXPLOSION-RESISTANT MOTOR

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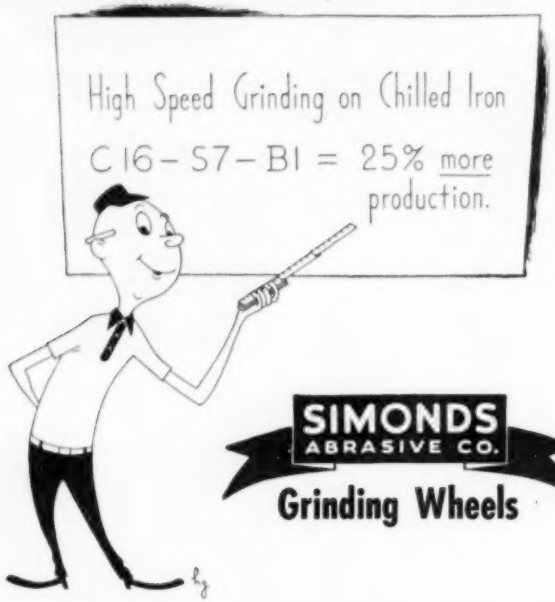
Here's how the Grinding Department figures it...



SIMONDS ABRASIVE CO.

Grinding Wheels

That 'formula' sure paid off in one grinding department. What does it mean? Simply this: a Simonds Abrasive Company grinding wheel—specification C16-S7-B1—boosted production 25%. Why? Because this wheel is accurately specified for the job it had to do. This is true of all Simonds wheel specifications. They're listed in our free data book, along with details on our complete line of grinding wheels, mounted wheels and points, segments and abrasive grain—plus information on how you can get Simonds wheels specially made for out-of-the ordinary jobs. Write for it. Also name of your nearby distributor.

SIMONDS ABRASIVE CO., PHILADELPHIA 37, PA. BRANCH WAREHOUSES: CHICAGO, DETROIT, BOSTON
DISTRIBUTORS IN PRINCIPAL CITIES

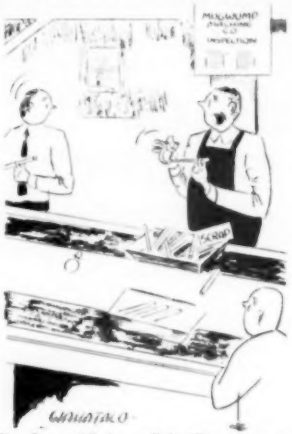
Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

an outsider with a suggestion for a radical change. If the thing does prove to be good, the top brass will inevitably wonder why I didn't see and suggest it long ago. It won't do me any particular good in their eyes, and it may do me much harm."

This may take place subconsciously to the extent that he is scarcely aware of it, but don't think he will fail to scrutinize the new suggestion from every angle, say nothing of its good points, if he sees any, and magnify its weak points to the fullest degree. He will sell his associate engineers on any such weak points as far as he possibly can, and point out risks involved in making any such change.

Al is one boy in a thousand in the attitude he is taking. The real truth, if it were possible to take advantage of it, lies between his view and Ed's. Let the outsider come in and do what he can, then call a council of shop foremen and other key men to go over the suggestions before the outsider has gone. Let it be fully understood that if any man has anything to say against the report or suggestions, "let him say it now, or forever after hold his peace." If any man has any worthwhile suggestions which would invalidate or modify those put forth by the "expert", let them be initiated then. This method would allow reaping anything the outsider has that is really worth while, yet prevent ruining anything that should definitely be retained of former practice. Having done this first, it would be perfectly safe to allow what remains standing to issue in the form of instruction cards.

Even after this, of course, there is no reason to suppose that a given instruction card should stand as it



"You know, Al, by a slight tilt you can get an 0.689 OD!"

Big loads
going up—

so
RADIOGRAPHY
checks the
crane wheel

YOU'RE dealing with big stresses and strains when you jockey multi-ton loads of metal around your plant. Every part of the crane must be ready for its job—with an extra margin.

That is why this crane wheel was checked by radiography. It was the one way to prove whether gas pockets or other internal defects might exist to cause a hazard.

Foundries working with all kinds of metals and alloys are finding it increasingly important to radiograph their castings. Then they know only quality products are released. Also in planning long production runs, radiography of pilot castings often indicates ways to improve methods and increase yield.

See your x-ray dealer. He'll gladly show you how radiography can increase your production and improve quality. Also send for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
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another important function of photography

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(W 6.50% —
Mo 5.00% —V 1.90%)

There are Columbia warehouses and highly trained Columbia representatives in principal cities. For service, for quality, look to Columbia — producers of fine tool steel by the electric process.

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is forever, or even for a protracted period of time. Such cards should be critically examined from time to time in the light of new discoveries, new machine installations, etc. Foremen should definitely be given a voice whenever practice revisions are to be made, whether an outside engineering firm is making a study at the time or not.

John E. Hyler
Peoria, Ill.

•

WHO SAYS HOW?

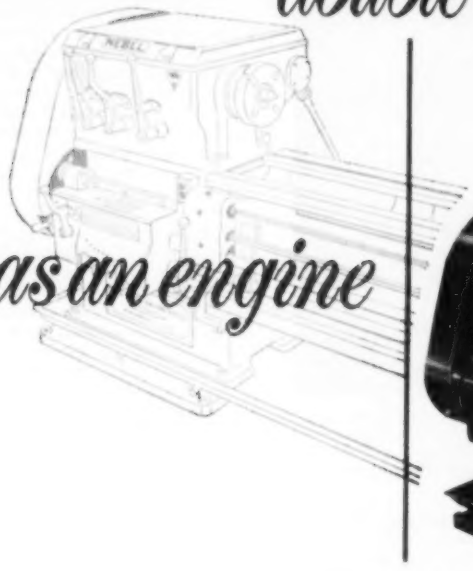
THE COMPANY has gone to considerable expense to prepare instruction cards containing written instructions on how to do the jobs in this particular shop. The cooperation of all the foremen in insuring the success of the new system should be without question. The idea that the job-instruction-card system will rob the foreman of his prerogative in furnishing exact instructions to the workers is beside the point. The company has hired industrial engineers to reduce costs and increase production. As a result of their studies and recommendations, the proposed job-instruction-card system was approved by management. It is now up to the foremen to see that the system is made to function. It is the hope of management that written instructions on how to perform specific jobs according to standard practice aid in standardization and simplification, with ultimate reduction of operating costs and increased production. Such worthwhile results should enlist the interest and aid of all the foremen in seeing that the system works.

I do not agree that exact written instructions will prevent the worker from exercising his ingenuity and skill in effecting improvements. Nor that he will be bound by the stated words and be merely an automaton, robbed of the initiative and pride of

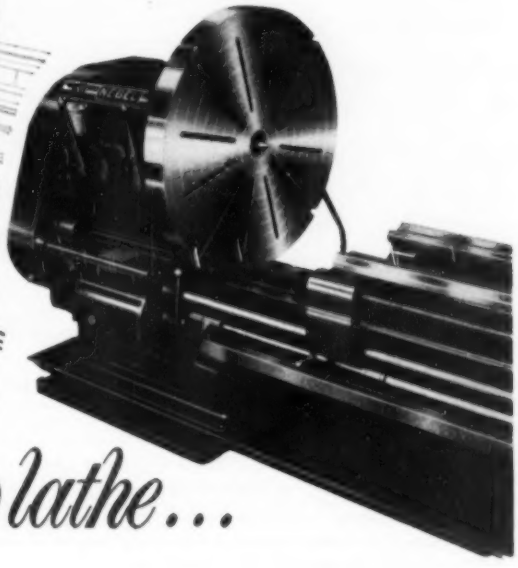
"That's the new chief of our extrusion department!"

Nebel

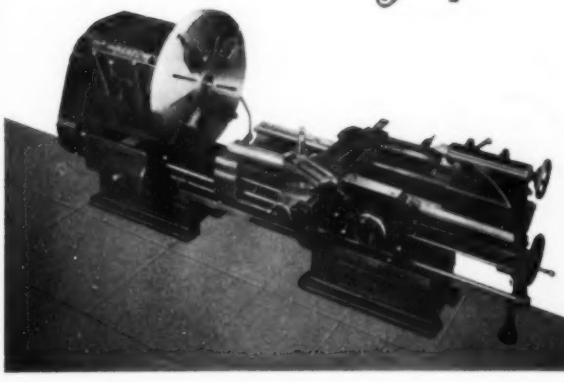
double duty gap lathes



as an engine



or a gap lathe...



The versatile dual purpose Nebel extension bed gap lathe . . . with its flexible swing and center distance capacity . . . with its tremendous power, wide range of speeds and feeds, and Nebel-built accuracy . . . offers the productive capacity of two ordinary lathes for the price of one.

For information on Nebel extension bed gap, removable block gap and heavy duty engine lathes, in swing sizes from 18″ to 50″, write today for descriptive bulletins.

THE NEBEL MACHINE TOOL CO., CINCINNATI 25, OHIO

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...outlining procedure widely used for these cost-cutting results:

Visual Scheduling . . . a glance at board shows work ahead for each machine or man.

Order Sequence . . . quickly indicated by arrangement of tickets representing orders.

Schedule Changes . . . easily specified by rearranging tickets in revised sequence.

No Delay Between Planning and Dispatching . . . no lists or records to write.

Operation According to Plan Assured

Readily Adapted . . . to production, assembly, maintenance, engineering and work of every variety, using work orders, time tickets, move tickets, tabulating cards, etc. and McCaskey Machine Control Boards.

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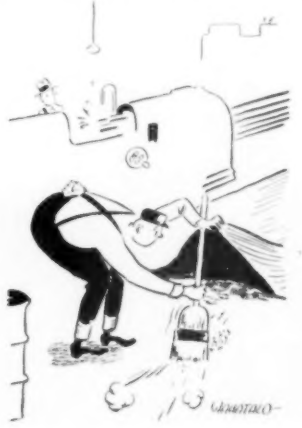
doing the job his own way. Furthermore, I do not think that covering the various steps in performance of a job from "A to Z" by written instructions also bypasses the foreman's valuable experience. The foreman is still available to guide the worker in interpretation of the instruction cards and to suggest short cuts and improvements from the store of his own experience. Job-instruction cards, as I have observed their use, are not rigid, unchangeable devices, but are a means of gathering together the best directions for doing a specific job.

Job-instruction cards which guide the worker along exact lines in doing his work relieve the man of the trouble of figuring out the job himself. If you were to give every man in the shop the same job, each would do it a different way. Instruction cards represent the standardization of the cream of accumulated experience acquired in the performance of a particular job. It is true that the foreman is relieved of the necessity of outlining the job to the worker. However, when the worker experiences any difficulty in interpreting the instructions to actuality, consultation with the foreman is a logical step. In this manner, the foreman is relieved of unnecessary work and will be able to function in his administrative and supervisory capacity.

I do not believe that the instruction card will limit the worker's initiative in bettering operating procedure. The characteristics of an efficient and skilled worker are his use of the best methods and the ease with which he adapts himself to new methods. In following the instructions listed on the card, the foreman should encourage rather than limit the worker in his interpretation of

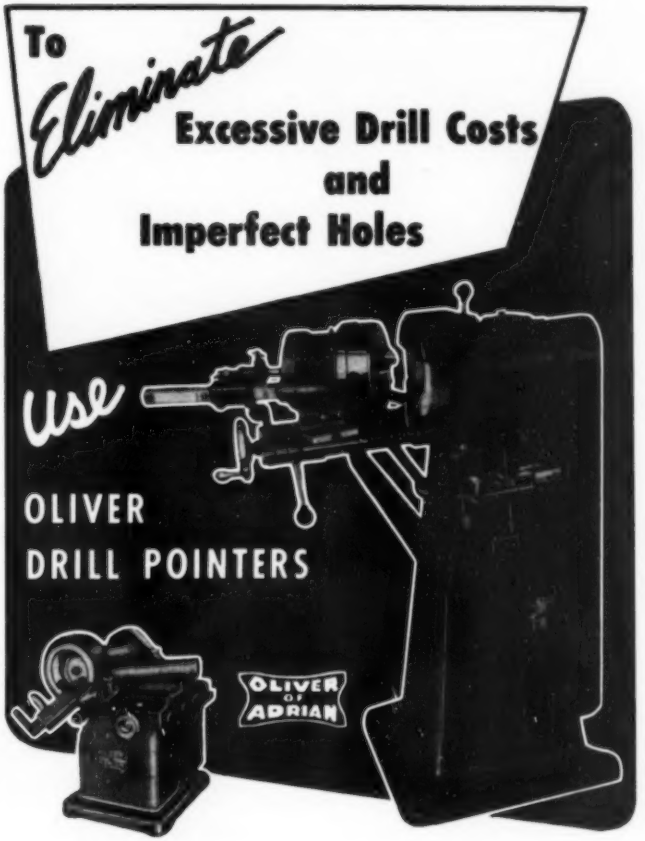


their exact applicability to his particular job. In this manner, a more efficient and economical method may be determined and the standard instruction card for the job revised accordingly.

Although the worker and foreman have the opportunity to revise the job-instruction card to incorporate beneficial ideas, from what I have seen of these cards, they are usually very comprehensive and effective. They inform the worker regarding the task in every particular, answering all questions of what to do and how to do it, and giving complete information on equipment, tools, and materials used. Sketches and drawings frequently supplement the cards to show arrangements or setups or in making instructions as clear as possible. These cards show the elements of the operation in the sequence in which they are to be performed and the time allowed for doing each. The equipment and tools required are listed, and there is space for including data as to speed, feed, depth of cut, and the particular machine to be used. The method of performance is made clear step by step. On the reverse side of the instruction card is supplied the rate per 100 pieces, with allowance time and all computations leading up to the determination of standard hourly production, so the worker can see for himself how the task was determined.

I approve of the instruction card because I believe it simplifies the giving of instructions, issuance of orders, and training of new workers. It provides permanent records of standard conditions and best methods, preserving good ideas, and checking tendencies to backslide. It assures regularity and thoroughness

"Well, don't get mad about it! I only used a few, I was gonna return them."



Many production slow-downs due to excessive drill costs and imperfect holes can be eliminated by using the method proven best for sharpening drills — machine grinding. OLIVER Drill Pointers give balanced cuts with each lip doing equal work—eliminating these excessive drill costs and imperfect holes which can usually be traced to improper drill point grinding. Drills, when properly machine ground, give far better performance than when ground by hand. Remember — twist drills should be removed from the drilling machine and replaced at the first sign of dullness — prompt attention to this condition, along with careful machine grinding, will increase their wearing life and accuracy. To produce more perfect holes with your drills . . . BE WISE, OLIVERize . . . Use OLIVER Drill Pointers.

THE OLIVER DRILL POINTERS

No. 510 for drills ¼" to 3"— 2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.

No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to ½". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

Write for literature that will save you dollars in your Toolroom.

OLIVER INSTRUMENT CO.

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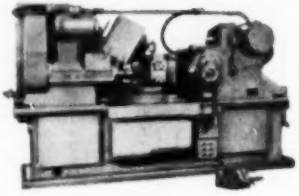

GOSS and DE LEEUW CHUCKING MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method—exclusive with Goss & DeLeeuw—provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DELEEUW

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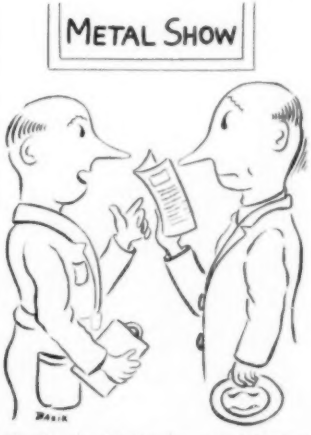
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

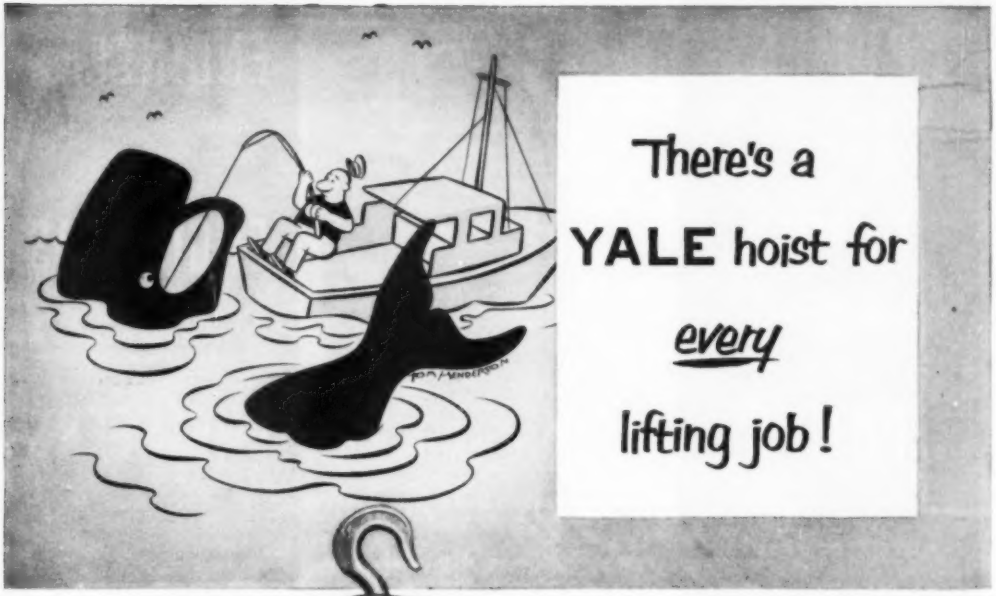
in the doing of jobs. More important, the written card may bring within the range of the worker tasks which he otherwise could not perform. In repetitive work, instruction cards are referred to less frequently as the worker becomes familiar with the task, but they are no less valuable as a record of methods and standards to be maintained. They are often helpful in the training of new workers. For jobs not frequently repeated they assure proper procedure and make certain the attainment of quality and quantity standards.

Written instructions take to all the workers the best known method of accomplishment. They do not prevent the worker from exercising his ingenuity and skill in effecting improvements; in fact worthwhile incentives should be offered to this end. However, they do prevent any retrogression and give all the benefits of innovations adopted. In this way they enable each person to benefit to the maximum from his efforts. They do for him what he would do for himself if he possessed the wide range of intelligence, and time, and command of facilities necessary for the compilation of this information. The methods or procedure outlined are logically the easy, natural methods and lend to perfection of accomplishment. The worker is no more degraded or made an automaton than any artist is when he strives for perfection of technique as indispensable to the best expression of his art. The practice of submitting to the worker complete data and information in written form provides every incentive for fair and accurate work.

Harry Kaufman
Philadelphia, Pa.



"Frankly, the ridiculous low price of the machine is made possible by our sky-high prices on the necessary attachments."



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CAPACITIES:
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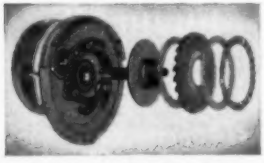
THE LOAD KING ALUMINUM HAND HOIST

is light in weight, efficient in performance and truly portable. Half-ton model weighs only 36 lbs. Precision engineering, and ball bearings in *all* rotating shafts minimize friction, raise hoist efficiency *up to 95 per cent*. The Load King's many safety features include SYNCHRO-MATIC Load Brake, Alloy Steel Gears and fractureproof steel Safety Hooks.



Only the YALE Load King

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If your problem is to save manpower—increase production—speed lifting of any weight from 500 lbs to 40 tons—get in touch with YALE. For YALE has pioneered in the development of safer, more efficient hoisting equipment of every kind. That's why your YALE Distributor can give you such valuable assistance in choosing the *right* hoist for your particular needs. He's listed in your Classified Directory, and ready to help you any time.

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☐ Please have your local Distributor call on me.
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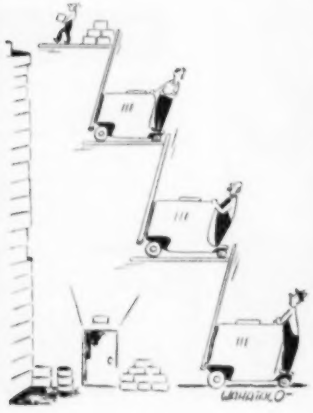
WRITE FOR CATALOG

POWER OF SUGGESTION

MANAGEMENT should be very careful when deciding upon the eligibility of the supervisors in any suggestion plan. It is quite common that they don't get anything for suggestions in their own departments, but for that reason I'm afraid many good ideas are never put into practice. I think it is wrong to leave the foremen outside contests, incentive systems, or suggestion plans. Why shouldn't they also be encouraged to do their utmost? The workers produce more when on piece work; the manager often gets his share of the profit, therefore does all he can to increase production. Why then, shouldn't the foremen participate on equal conditions with the others?

Do people steal ideas? The question is not superfluous. Many years ago I used to help an elderly American mechanic by making drawings in my spare time. He held many patents, one of which included about 300 claims. During his span of life he had made thousands of suggestions, some of which had been very beneficial to his employers. One evening while we were discussing a machine for the shoe-repair trade he suddenly exclaimed: "Whatever you do, don't meddle with suggestions. I have designed many machines and made many suggestions on which big business has made millions of dollars, yet I am poor." Stealing ideas or suggestions cannot be accepted morally or economically. Reading advertisements about arbor presses or precision gage blocks in American technical magazines suggests questions for those who know as to who really invented these useful tools.

Evidently suggestion plans are double-edged swords, but I think they are necessary. Without them we would lose the power of progress in-



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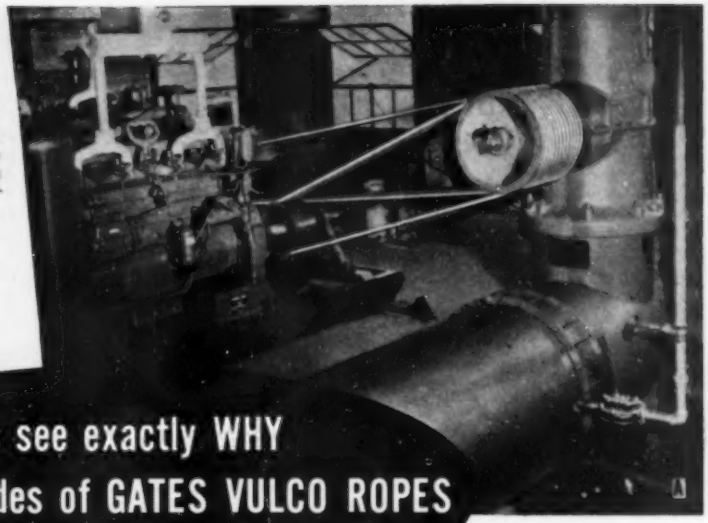
INQUIRIES PROMPTLY ANSWERED



To drive one of the new high capacity pumps which removes surface water and runoff from 15,000 acres of Illinois farmland, members of the District Board chose Gates Vulco Ropes, running from two diesel units.

Let's see exactly WHY the Concave Sides of GATES VULCO ROPES mean lower V-Belt Costs!

Every engineer knows how a V-belt *changes shape* when it bends around a pulley.

The top of the belt is under tension—making it grow *narrower.*

The body is under *compression,* causing the sides to bulge out!

Look at figure 1-A in the diagrams, herewith. There you see how a *straight sided* V-belt is forced to bulge in its sheave-groove—and this bulging naturally causes extra wear along the middle of the sides as indicated by the arrows.

Now look at the figure 2-A. There you see how the precisely engineered Concave Sides fill out to an exact fit in the sheave groove.

Clearly, the Concave Sides press *evenly* against the V-pulley. This means uniform wear; longer life! The Concave Sides have *full traction;* wear longer because of *full contact!*

To sum up: The Concave Sides of Gates Vulco Ropes (U.S. Patent No. 1813698) give you (1) Less wear, (2) More pulley contact, (3) More sure power transmitted when needed!

Only V-belts made by Gates are built with concave sides. Whenever you buy V-Belts, be sure you get the V-Belt with the Concave Sides—The Gates Vulco Rope!

What Happens When a V-Belt Bends

How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

The Concave Sides Fill out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

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cluded in them. It is, however, up to those taking part in such plans to defend their rights. If such stringent eligibility rules are laid down for the supervisors that they feel they get nothing in return for their efforts, I don't blame them if they keep their ability hidden. Recognition in higher pay is, of course, a good thing, but depends upon the amount involved.

If the employers know how to handle their executives, they can probably get the most out of them, even if they are barred from participating in the general plan. But, if so, why can't they have a plan for themselves?

Whether method or safety ideas, suggestions should be taken care of in such a way that everybody taking part feels he gains something.

A. E. Fristedt
Stockholm, Sweden

•

NOT ENOUGH CHIEFS

Is job rotation practical where production schedules must be met? Can you build up versatility in a machinist without detracting from his proficiency as a specialist? Or is the reserve of training on all-around work worth more? In a large part based on practical experience, our readers think —

JOB-ROTATION today, when every man must be pressed to do his utmost, is perhaps not right, but would be of great value of the whole mechanical industry when times are slack. There are always some men in every shop who might be moved around without disturbing production. But this is also a matter of personal liking. Some fellows lose efficiency if the boss tells them to do new jobs, while others enjoy getting a chance to work with different objects and tools and on diversified processes.

Many years ago, Mr. Ford tried the idea, which I understand varied with different men. One man who had

"Wha'd ya want I should do—get a certificate of necessity?"

been hardening gears for decades was offered a new job. His duty was to catch a gear with a hook, put it into a furnace and take another heated gear with the same hook and quench it in water. He went over to his new job reluctantly. After a few days he asked to have his old job back. Another man felt happier every time he was told to do a new job. This illustrates the reaction among any group of men in industry. Some are ideally fitted to be specialists and others more suited to shift from job to job.

For those who prefer rotation it is probably a matter of educating themselves to better jobs, while for other types their brains are not suited to rise above the average, they prefer to use their faculties as little as possible in repetitive work.

I think Al is right when he says that once a man has tried all the jobs, he'll probably settle down to one by preference. Should some of the men have real potential they will be greatly helped by job-rotation.

Job-rotation is practical, within certain limits, when due dates must be met, and essential when such dates are not fixed.

A. E. Fristedt,
Stockholm, Sweden

NEW BOOKS

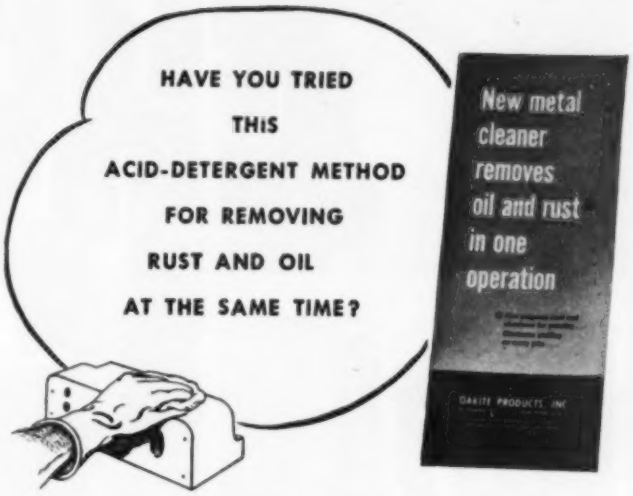
MECHANICAL WORLD YEAR BOOK (65TH EDITION). *Published by Emmott & Co. Ltd., 31 King St., West, Manchester, England. 508 pages, price 3/8.*

Each new edition of this old-established yearbook includes some new and worthwhile feature. This present edition features an 11-page section dealing with patents and inventions, and an outline of patenting procedure. The section on gas turbine has been retained, and the entire book has been completely revised to keep it up to date.

•

BASIC BLUEPRINT READING AND SKETCHING—*By C. Thomas Olivo and Albert V. Payne. Published by Delmar Publishers, Inc., Albany, N.Y. 145 pages. Price $2.25 (plastic bound), $3.40 (cloth bound).*

Reading shop blueprints and making rough but clear shop sketches without drawing instruments are two things most new shop men can't do; especially where labor shortages demand the hiring of unskilled help.



Metal craftsmen using Oakite Compound No. 33 say it is just what they've been looking for: a metal-cleaner that combines three important operations into one:

1. **It removes rust** *at the same time that*
2. **It removes oil** *at the same time that*
3. **It prepares the metal for painting**

Oakite Compound No. 33 removes rust, heat scale, tarnish, other oxides, stamping and forming oils, rust preventives, carbon smuts, soldering and welding fluxes, identification inks and similar soils. It develops excellent paint adhesion on steel, cast iron, aluminum sheet and castings.

For Use in Tanks or by Hand—Oakite Compound No. 33 is great for soak-cleaning metal parts of moderate size; and great for hand-swabbing on large metal surfaces.

Often Avoids Pickling—Oakite Compound No. 33 removes rust and oil so successfully that it frequently eliminates the need for a cycle of separate cleaning, pickling, neutralizing and paint-conditioning operations. It saves money in many ways.

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PENNSYLVANIA: "Well pleased with removal of drawing compound, heat scale, rust and oil. Parts coming through good and clean."

CALIFORNIA: "This material is a beauty . . . one we've been waiting for on this jeep overhaul job."

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MICHIGAN: "Removing rust for less than 9 cents per wheel; sand blasting cost 25 cents."

TEXAS: "Eliminates practically all rejects and also handwiping of booster caps."

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ILLINOIS: "Works a miracle taking heavy rust off steel cabinets."

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Slanted toward a low or medium educational level, this book is a set of lessons in drawing and blueprint interpretation that should be useful in the shop. Most of the drawings are white on blue, which will familiarize the student with factory drawings. Through questions and answers, the book can serve as a home-study course or as a classroom text to teach the understanding of blueprints. Best drafting practices are included, so the book can also serve as a reference for drafting departments.

Orthographic projection, perspectives, sectioning, and lettering are covered.

•

PROCEEDINGS, METAL POWDER ASSOCIATION, SEVENTH ANNUAL MEETING.—*Published by the Metal Powder Association, 420 Lexington Ave., New York 17, N.Y. 85 pages. Price $2.50*

In printed and bound form, this book contains all of the papers, illustrations, and post-paper discussions presented at the meeting which took place at the Hotel Cleveland, Cleveland, April 25-26, 1951.

Among papers are: The Flywheel Effect in Infiltrated Metal Parts; Powdered Iron Materials in High-Frequency Transformers for Military Use; Metal Powders in Small-Arms Ammunition Sintered Iron Rotating Bands and Cemented Carbide Cores for Ordnance Use; Sintering of Brass Powders, Metallographic Study; Powder Metallurgy vs Drawn Wire Method of Producing Gears; Metal Powder Applications in the Home Appliance Field.

•

GEARS—SPUR, HELICAL, BEVEL AND WORM—*By P. S. Houghton. Published by The Technical Press Ltd., Gloucester Road, Kingston Hill, Surrey, England. 390 pages. Price 50 shillings.*

Intended equally for the draftsman, the shop superintendent and foreman, the machinist, the inspector, and the engineering student, this book presents the entire picture of gears in a comprehensive and workmanlike manner. Each type of gear is considered in detail, with all the factors governing its geometry and applications, and specific examples are worked out to show exactly how to proceed.

Chapters are included on gear cutting and finishing, on estimating production time, and on gear inspection, as well as on gear materials, horsepower calculations, and trig.

Rivett offers the Series 9100 Power Unit as the ideal source of power for your hydraulic circuit. The unit is equipped with pump, relief valve, oil filter, pressure gauge, and all equipment to furnish a steady flow of oil at continuous working pressures up to 1000 P.S.I. Reservoir is available in 6 tank sizes, with pump capacities from .4 G.P.M. to 40 G.P.M. Motor mounting may be arranged for any standard frame. Series 9200 with double pumps are supplied for two separate circuits of different pressures.

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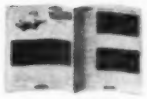
Starting the electric motor results in the continuous reciprocating of the cylinder rod. In one position of the Model 5805 Pilot operated 4-Way valve, oil is directed from the pump to the blind end of the hydraulic cylinder, causing the cylinder to extend at its rated speed. When the machine table advances to where it depresses the cam of Model 8630 flow control valve, the forward speed of the cylinder is affected by the setting of the flow adjusting screw of Model 8630 valve. In the other position of Model 5805 valve, oil is directed from the pump to the rod end of the hydraulic cylinder causing it to retract at full rated speed. In this direction of cylinder movement, Model 8630 has no effect on the speed of the cylinder. Model 7205 Pilot valve provides for remote hydraulic operation of the main 4-Way valve, Model 5805. The forward, or return stroke of the cylinder may be manually interrupted at any time by reversing the handle of the Model 7205 Pilot valve.



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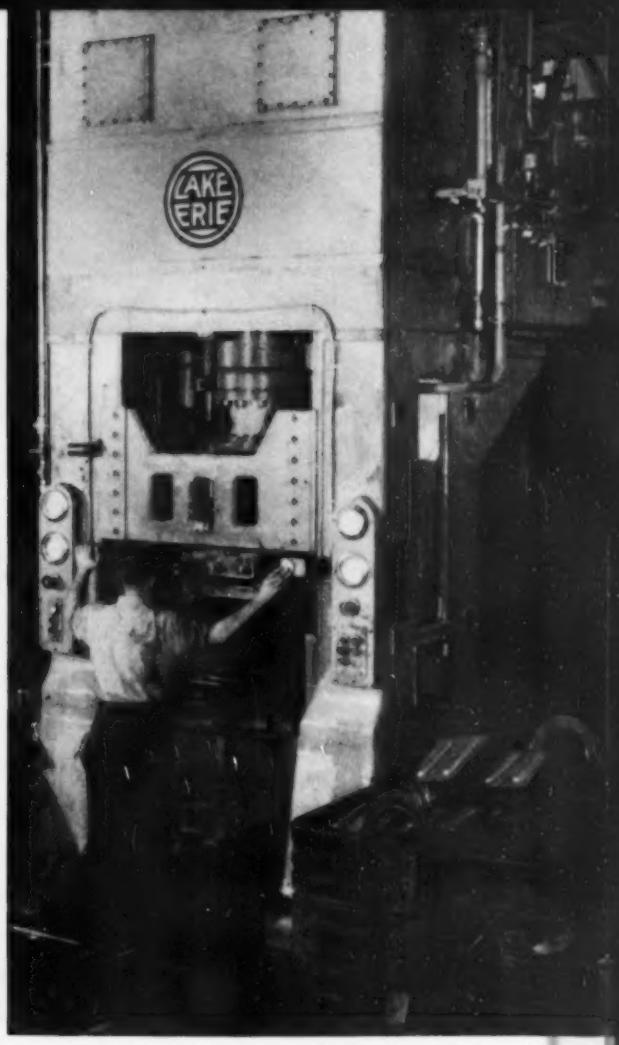
Pratt & Whitney Aircraft, Allis Chalmers and International Harvester are but three of many well-known manufacturers who report great savings in time and materials after installing Lake Erie hydraulic equipment. Lake Erie equipment also enabled these manufacturers to improve product design and reduce assembly operations.

At Lake Erie we are convinced after numerous production method surveys by our experienced engineers, that many manufacturers are producing products today which cost more and take longer to build than is really necessary. Unless you have investigated the production improvements possible through the application of Lake Erie hydraulic press power you may be overlooking the opportunity to materially benefit your company.

Lake Erie hydraulic presses cover such a wide range of capacities and types of applications that they find use in practically all branches of industry...in plants large and small. We welcome your inquiry and will be glad to extend our help toward improving your production methods.



REDUCES UNIT COSTS When tooling for crawler type tractor production at the Allis Chalmers plant a 100 ton Lake Erie Hydraulic Press was selected as the "best piece of equipment to economically produce certain required parts." This press is used to form a number of different parts from sprocket guards to motor supports. *This is only one of more than a score of Lake Erie hydraulic presses chosen by Allis Chalmers.*

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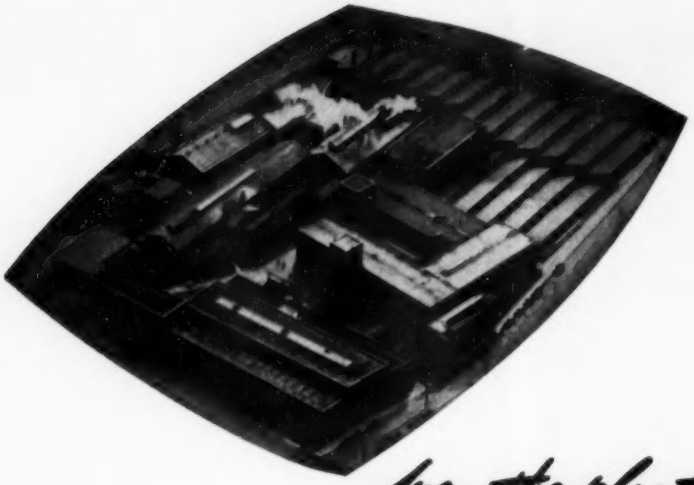

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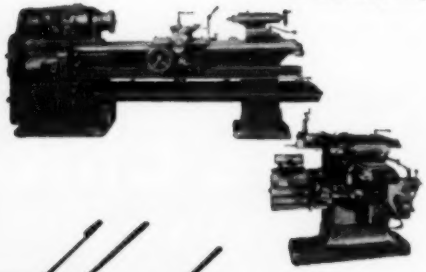

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An entirely new kind of lubricant that

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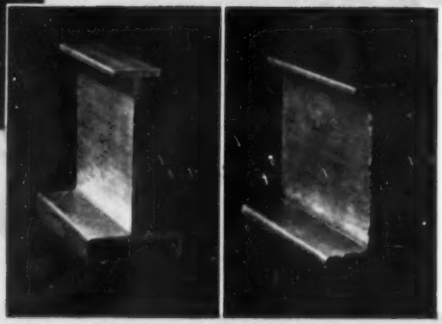

Sawed sections of aluminum extrusion. Left: section sawed with Johnson's No. 140 Stik-Wax is burr-free. Right: section sawed with grease stick shows bad burr.

On grinders
Stik-Wax lubricates to reduce heat—wheel clogging.

On belt sanders
Stik-Wax lubricates to give better finish—longer belt life.

On taps
Stik-Wax lubricates to cut smoother threads—increase life of taps.

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Johnson's No. 140 Stik-Wax is the new wax lubricant that outperforms grease sticks, tallow, bar soaps. Saves materials and tools . . . saves time . . . produces higher quality work.

Exhaustive tests have shown that the performance of Johnson's No. 140 Stik-Wax far exceeds that of ordinary lubricants for drilling, grinding, sawing, tapping, spinning and pipe cutting. Taps and drills last far longer. Saws and cutters need sharpening much less frequently. Sanding belts and disks get added life . . . give cleaner, smoother finishes.

Applied manually or automatically, there is no end to the metal working lubricating jobs that Stik-Wax will do *better* to *speed* jobs . . . *add life* to equipment.

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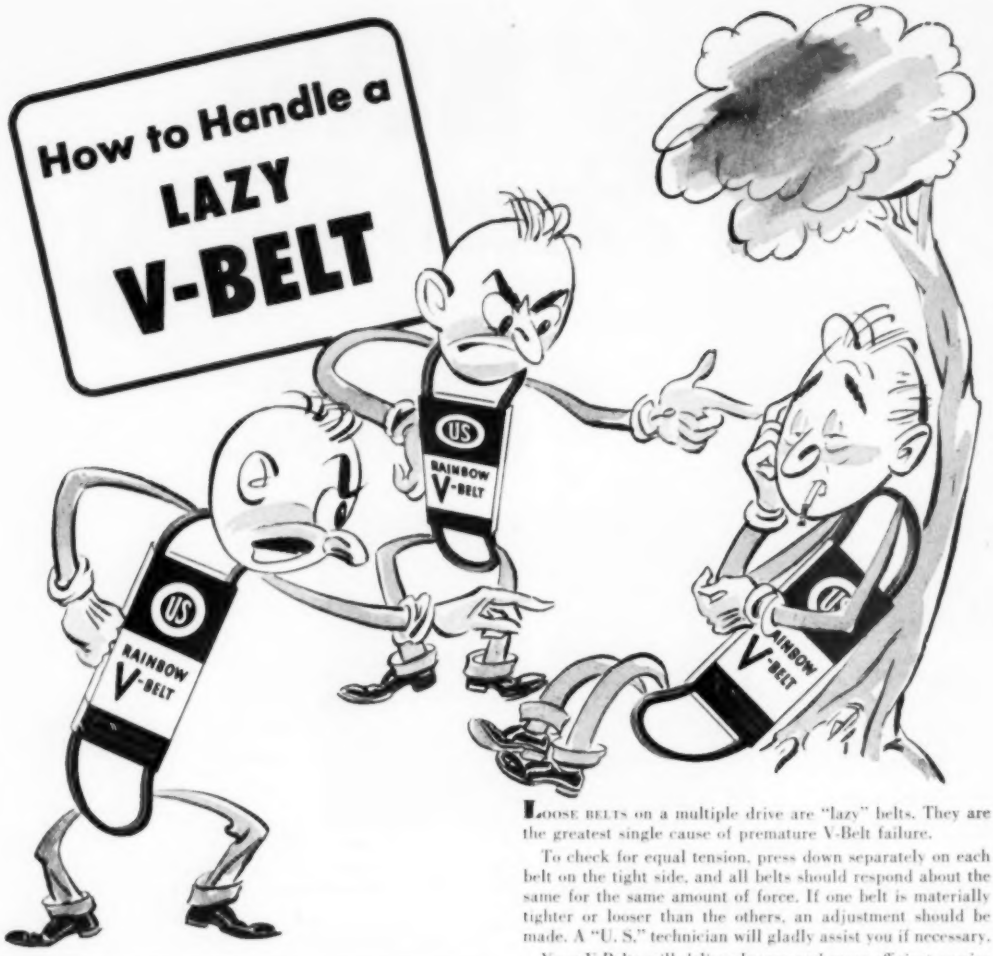
Name _____ Title _____

Organization _____

Address _____

City _____ State _____

How to Handle a LAZY V-BELT

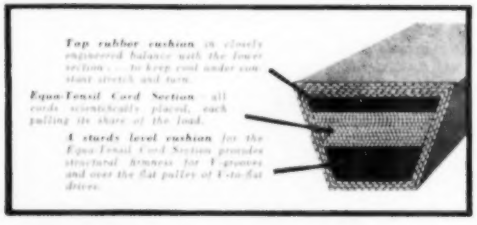


LOOSE BELTS on a multiple drive are "lazy" belts. They are the greatest single cause of premature V-Belt failure.

To check for equal tension, press down separately on each belt on the tight side, and all belts should respond about the same for the same amount of force. If one belt is materially tighter or looser than the others, an adjustment should be made. A "U. S." technician will gladly assist you if necessary.

Your V-Belts will deliver longer and more efficient service if they are made by "U. S." The cords in "U. S." belts have had their stretch worked out by mechanical means, while retaining enough elasticity to enable the belt to withstand severe shock loads. To reduce any heat generated by constant flexing, and to get maximum adhesion between the component parts of the belt, the cords are treated with latex.

Every "U. S." Belt has the unique Equa-Tensil Cord Section —the U. S. Rubber development that insures efficient pull and strength under diverse operations. Order from your jobber, or for more information write to address below.



Top rubber cushion in closely engineered balance with the lower section . . . to keep cord under constant stretch and turn.

Equa-Tensil Cord Section — all cords scientifically placed, each pulling its share of the load.

A sturdy level cushion for the Equa-Tensil Cord Section provides structural firmness for V-grooves and over the flat pulleys of Cog-flat drives.

A COMPLETE DRIVE SERVICE
MULTIPLE V-BELTS
F. H. P. BELTS • SHEAVES
FLAT BELTING AND BELTING
SPECIAL PURPOSE BELTS

PRODUCTS OF
U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY
MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

DoALL PRODUCTION NEWS

Vol. 1 Published by The DoALL Company, 254 N. Laurel Ave., Des Plaines, Illinois No. 3

New Literature Available From DoALL

1. DIMENSIONAL QUALITY CONTROL WITH DoALL GAGE BLOCKS. 24 page catalog explains and illustrates need for and many uses of DoALL Blocks for checking tools, dies, parts, other gages. Lists all sets, accessories and services.
2. GROUND FLAT STOCK SIZE AND PRICE CHART. Ideal for anyone using tool steel. Shows 238 standard sizes and prices of DoALL oil hardening tool steel.
3. BAND TOOL SELECTION AND USE. 160 pages of valuable "how to do it" band machining information. Tells proper band tool to use, speeds, feeds, coolants, pitches, other factors necessary to saw, slice, file, grind or hone any material. Price $2.00.
4. ADVANTAGES OF THE DoALL MP-20 CONTOUR-MATIC BAND MACHINE. Comprehensive 16 page catalog tells how and why DoALL band machining saves time, money and metals—how it saws, slices, friction saws, grinds, polishes, files and hones all metals, all non-metallics—how it machines any material to any profile. Fully illustrated.
5. THE SCIENCE OF PRECISION MEASUREMENT. 256 page text dealing with the purposes and applications of gage blocks, monolites, sine bars, optical flats, electric comparators and various statistical systems. Ideal for maintaining better dimensional quality control in all manufacturing. Price $3.50.
6. DoALL PRECISION HYDRAULIC SURFACE GRINDING AND "COOL-GRINDING." Many new ideas and methods for better production and tool room grinding. Shows how rigid construction and hydraulic operation speeds grinding, preserves accuracy. Explains how "Cool-Grinding" multiplies DoALL grinder efficiency.
7. NEW DECIMAL EQUIVALENT CHART. Real time saver for making fast calculations — fractions in 1/16ths, 32nd and 64th and their decimal equivalents shown in different columns and colors for easy reading.

This literature can be secured from your local DoALL Sales-Service Store or by writing The DoALL Company, 254 N. Laurel Ave., Des Plaines, Ill.

DoALL BAND FILER SAVES TIME, TOOLS, LABOR

Four to Nine Times Faster Than Other Methods, Requires No Special Skill

DoALL Band Filing offers unusual opportunities for reducing costs and increasing production on a wide variety of internal and external filing jobs. The operation is similar to vertical band sawing. The band file, consisting of file segments riveted to a flexible steel band, travels continuously in one direction only, cutting all the time. Filing speed is four times that of jig filing, about nine times that of hand filing. Because there is no backstroke to cause wear and tear, the file bands last longer than jig or hand files.

No special skill is required to operate the band filer. The operator simply guides the work into the file. DoALL Selection Charts tell him which of the wide range of file bands, and what band speed, to use to secure the maximum cutting rate consistent with desired tool life and required finish. The infinitely variable speed range of the DoALL Band Filer is of great value here, permitting the optimum speed for any of the wide range of metals, including new alloys, being used today.

Case Studies

Users reports indicate the savings possible in various applications of band filing. In a large foundry one man is now band filing seven times as many castings as he formerly filed by hand. In another plant 90% of the filing operation on a punch, die and guide plate was being done with a jig file and the remaining 10% by hand. Now a DoALL Band Filer does the job four times as fast as the jig filer and eliminates most of the hand filing.

Often a DoALL Band Filer can do jobs such as slotting or notching and thereby release milling machines, broaching machines and shapers for other work. One plant is now band filing flats on shafts and has released for other work the expensive milling machine formerly used for the operation.

Low capital investment and low operating costs make the DoALL Band Filer a logical addition to any shop where production filing is done. Band filing can also be done with other models of DoALL band machines.

The DoALL Research Laboratory is equipped to run band filing tests on sample pieces submitted and will issue a complete report on the results secured. A Band Filer demonstration will also be conducted at any plant requesting it.

No special skill is required to operate a DoALL Band Filer.

Wide Range of Sizes of DoALL Flat Stock Save Money for User

The 238 sizes of DoALL precision ground oil hardening, flat stock make it possible for tool steel users to purchase the size best suited to their needs and thereby eliminate waste and reduce costs of making tools, dies, parts or gages. Delivery at present is prompt on all 238 standard sizes carried. Special sizes are also obtainable.

* * * *

There are 32 DoALL Sales-Service Stores in the United States, two in Canada and one in Mexico, equipped to conduct free demonstrations of DoALL products in any plant upon request.

. . . CAN YOUR SURFACE

"Our DoALL Grinder is 50% faster than previous machine and tool life is increased 20% because of better finish", says Rahoal Corporation, Milwaukee, Wisconsin.

Rigid DoALL Surface Grinders Can Take Heavier Cuts and Produce Precision Work Faster

TRY THE TEST illustrated at the right. Take the heavy cut, reverse the crossfeed and let the wheel run back over the ground surface. If it sparks it is grinding again, showing that the wheel didn't take the full depth of cut on the first pass. If it is a DoALL Grinder it won't spark; in fact, if you stop the work under the wheel and shut off the motor the wheel will coast to a stop without touching the work surface.

Now, pencil mark the work surface. Lower the wheel .0001", start the grinder and the wheel will erase the pencil mark.

There is proof of the rigidity and precision of a DoALL Grinder! There is why it will do a given job in less time. You can take a heavier cut without "give" in the spindle or the table. The wheel doesn't climb over the work piece—it cuts true in one pass. There is no back-lash, slop or hang-up in the vertical column—you can control the vertical feed to lower the wheel as little as .0001" even after a heavy cut.

And, with DoALL "Cool-Grinding"* you can take full advantage of this rigidity and precision—take the heavier cuts without burning the work—get a better finish and sharper edges. Coolant flows in at the hub, *through* the wheel and out *at the point of contact* in a fine mist. There is always coolant where the heat is generated, unlike flood cooling where the wheel blasts the coolant away from point of contact.

There is a DoALL Surface Grinder with hand or hydraulic crossfeed for every toolroom or production requirement. Call your local DoALL Sales-Service Store today or write:

THE DoALL COMPANY

254 N. Laurel Ave., Des Plaines, Illinois

35 Local Sales-Service Stores in North America

* U.S. Patent No. 2470350. Available as extra equipment on all DoALL Surface Grinders.

GR-6

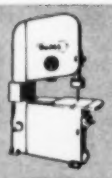
HERE'S WHY DoALL PRECISION HYDRAULIC SURFACE GRINDERS ARE FASTER, MORE RIGID, MORE ACCURATE!

MASSIVE FRAME—column support and base are single-piece chrome nickel steel casting, strongly ribbed for great rigidity.

HUSKY SPINDLE SUPPORT, dowelled and bolted to column, prevents wheel from chattering or springing away from work.

VERTICAL FEED IN INCREMENTS OF .0001"—made possible by ridigity and precision of extra-long 30" column.

CONTOUR-MATIC



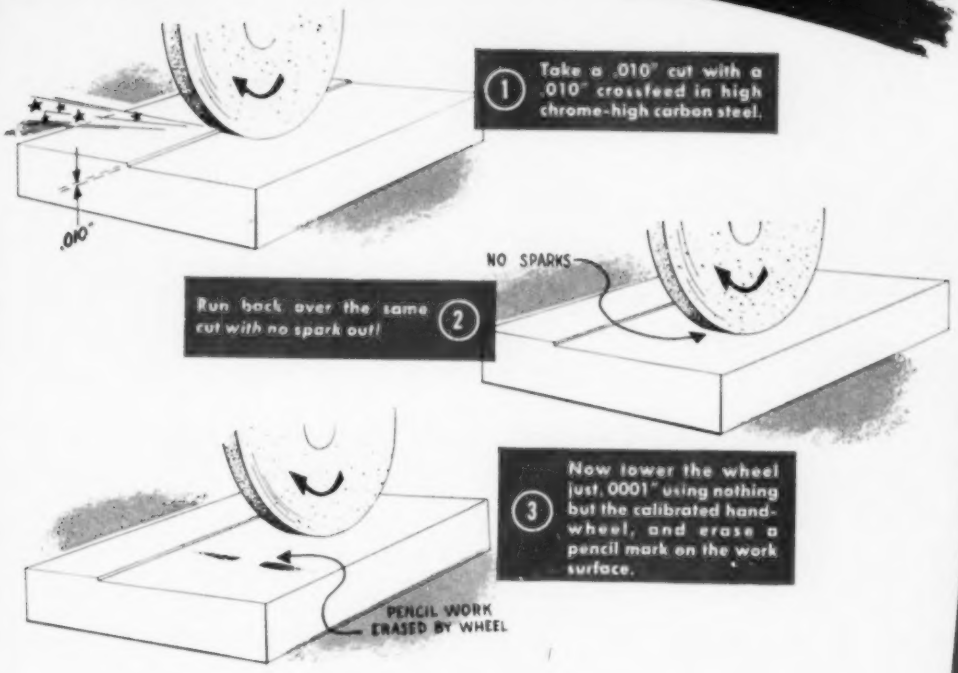
ZEPHYR

CONTOUR

BAND FILER

SAW BANDS

GRINDERS DO THIS?

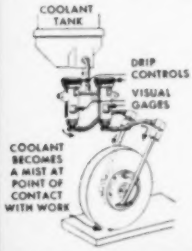


① Take a .010" cut with a .010" crossfeed in high chrome-high carbon steel.

② Run back over the same cut with no spark out!

③ Now lower the wheel just .0001" using nothing but the calibrated handwheel, and erase a pencil mark on the work surface.

You can see the above test as part of a complete demonstration of a DoALL Precision Surface Grinder right in your own plant, without cost or obligation. Call your local DoALL Sales-Service Store today.



"COOL-GRINDING" ATTACHMENT—reduces cutting temperature as much as 400°F; prevents burning, warpage, checking, skin softness.

FULL HYDRAULIC *DRIVE* of table and crossfeed, not merely a hydraulic control of a mechanical drive. Smoother, longer-wearing, quieter; more uniform motion for smoother finish, greater precision.

DoALL

Ask ... Descr...

TOOLROOM GRINDER

CRUSH GRINDER

GAGING EQUIPMENT

MONOLITE

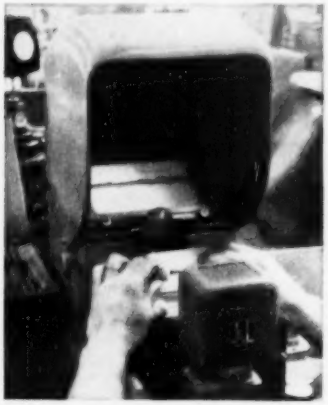
MOBILE INSPECTION UNITS

TOOL STEEL

DoALL Saw Bands Unconditionally Guaranteed

83 Inspections Assure Absolute Certified Quality

"Absolute satisfaction as to quality or replacement at no cost," is the guarantee that goes with every DoALL saw band. The most exacting quality control standards are maintained by DoALL. Special alloy steel for DoALL saw blades is subjected to rigid tests for thickness, width, camber, wedge, lip, edge roughness, edge radius, Rockwell hardness, weldability, cracks, brittleness, tensile strength, yield point, carbide size and distribution. Inspection is **certified** by tagging the tested samples. This record follows the steel throughout manufacture to the ultimate consumer. Many more laboratory, visual and mechanical inspections are carried on during the operations of toothing, setting, heat treating, tempering and on into packaging—during which, other samples are taken and subjected to re-examination. These are but a few of the many inspections that make DoALL saw bands the finest quality blades obtainable for any vertical or horizontal band sawing machine or cut-off saw.



Checking a DoALL saw band sample for accuracy of set with an optical comparator.

New Plastic Box Announced for 83 Piece DoALL Gage Block Sets

An attractive, warp-proof, moisture-proof, jet black plastic box is now being used to house 83-piece DoALL gage block sets. This box is designed to accommodate the blocks in a standing position for easier accessibility. It also has a new "double catch" safety feature. Both catches have to be snapped before the box will open, a safety feature which requires that the box be placed on a bench before it can be opened. This prevents accidental opening of the box and dropping of blocks while case is being carried from one place to another.

The hinged cover of the box can be made to lie flat to provide a tray for safely holding blocks and accessories while in use.

Helpful information regarding use, temperature control, identification, calibration, general care and service of DoALL blocks is found on a label affixed to the underside of box cover.

The new plastic boxes are available separately to present owners of 83-piece gage block sets who wish to replace old wooden containers.

CALL DoALL locally at these Sales-Service Stores

BALTIMORE 12, MD.
5621 York Rd.
Call DoALL: Hopkins 5340

BIRMINGHAM 4, ALA.
800 N. 24th St.
Call DoALL: Birmingham 3-0502

BROOKLINE 46, MASS.
89 Washington St.
Call DoALL: Longwood 6-9555

CEDAR RAPIDS, IOWA
624 Fifth St., S.E.
Call DoALL: Cedar Rapids 3-0616

CHARLOTTE 2, N. C.
405 S. Mint St.
Call DoALL: Charlotte 4-2579

CHICAGO 39, ILL.
4650 W. Fullerton
Call DoALL: Albany 2-5300

CINCINNATI 2, OHIO
536 Sycamore St.
Call DoALL: Main 3929

CLEVELAND 3, OHIO
6517 Euclid Ave.
Call DoALL: Express 1-1177

DALLAS 2, TEXAS
1628 Industrial Blvd.
Call DoALL: Sterling 3819

DAYTON, OHIO
725 S. Main St.
Call DoALL: Michigan 2121

DETROIT 27, MICH.
15010 Plymouth Rd.
Call DoALL: Broadway 3-4141

DENVER 4, COLO.
1187 Stout St.
Call DoALL: Alpine 7444

GRAND RAPIDS 7, MICH.
410 Hall St., S.E.
Call DoALL: 5-2191

HARTFORD 5, CONN.
45 Farmington Ave.
Call DoALL: Hartford 5-6664

HOUSTON 2, TEXAS
121 St. Emanuel
Call DoALL: Capital 6588

INDIANAPOLIS 2, IND.
1401-3 N. Illinois St.
Call DoALL: Plaza 6496

JACKSONVILLE 7, FLA.
1106 Kings Ave.
Call DoALL: Jacksonville 9-7087

KANSAS CITY 6, MO.
1019 E. Truman Rd.
Call DoALL: Harrison 5857

LOS ANGELES 21, CALIF.
1316-18 S. Santa Fe
Call DoALL: Trinity 3871

MILWAUKEE 5, WISC.
2427 W. North Ave.
Call DoALL: Division 2-2950

MINNEAPOLIS 14, MINN.
2510 University Ave., S.E.
Call DoALL: Gladstone 1173
St. Paul—dial red "O" for Zenith 2399

NEW YORK 10, N. Y.
67 Lexington Ave.
Call DoALL: Murray Hill 4-1514

NUTLEY 10, N. J.
88 Park Ave.
Call DoALL: Nutley 2-6767

PHILADELPHIA 24, PENNA.
2053 E. Glenwood Ave.
Call DoALL: Cumberland 8-7400

PITTSBURGH 21, PENNA.
600 Rebecca Ave.
Call DoALL: Fremont 1-5200

ROCHESTER 5, N. Y.
215 Central Ave.
Call DoALL: Hamilton 8420

ROCKFORD, ILL.
123 Seventh St.
Call DoALL: Rockford 47848

SAN FRANCISCO 3, CALIF.
952 Howard St.
Call DoALL: Garfield 1-4784

SEATTLE 22, WASH.
520 E. Pike St.
Call DoALL: East 7500

ST. LOUIS 6, MO.
1945 N. Broadway
Call DoALL: Central 3620

TOLEDO 6, OHIO
2952 Monroe St.
Call DoALL: Garfield 8309

TULSA, OKLA.
207 W. Archer St.
Call DoALL: 35443

CANADA

MONTREAL, QUEBEC
583 Inspector St.
Call DoALL: University 1264

TORONTO 10, ONTARIO
37 Clarkson Ave.
Call DoALL: Redfern 4238

MEXICO

MEXICO CITY, D. F.
Maestro Antonio Casso #48
Call DoALL: Mexicana 36-27-95
or Ericcson 18-62-74

No. 2—88M—3-52

PRINTED IN U.S.A.

Oerlikon to be Producing Munitions Here by Mid-Summer for Air Force

WASHINGTON — America's first fully-integrated munitions manufacturing project was off the ground last week. Oerlikon Tool & Arms Co. of Zurich, Switzerland, has started construction of its American subsidiary, Oerlikon Tool & Arms Corp. of America at Swananona, N. C., ten miles east of Asheville in the mountains of western North Carolina.

Lt. Gen. Kenneth B. Wolfe (ret.) president of Oerlikon-America announced that ground has been broken and foundations laid for two buildings in the $3½ million current construction program.

During the early stages of construction and operation Oerlikon-America will stay close to its parent company, both from an operational and financing standpoint. However, as the company gets on its feet it will move away from the Swiss company as it draws in both American capital and management.

• **The company's subcontractors** will be invited to buy stock once it gets operating. General Wolfe says considerable interest has been shown by American interests, but so far plans do not call for any public sale of stock.

Foundations already are in place on a production building that will contain 50,000 sq ft and on a rocket and gun-firing range. Construction of these two projects are expected to be completed in less than two months.

• **By mid-summer** Oerlikon-America expects to begin testing on its rocket and gun-firing range and to begin handling assembly-type contracts in the production building. These will be mainly prime and subcontracts on military work for the Air Force.

Once munitions manufacture has been stabilized, Oerlikon-America will begin to produce non-military items similar to those made by the parent company. These will include precision jig borers, gear generating machines, and the Oerlikon precision lathes. If and when demand for munitions subsides, General Wolfe says the company will convert to machine tool production without any reduction in its operations.

B-36 elevators being assembled at Luscombe Airplane Corp.'s Garland, Texas, plant, necessitate the use of the huge jigs shown. Work platforms around the frames allow for three different working levels. Luscombe, a subsidiary of Texas Engineering & Mfg. Co., is doing subcontract work on bomber assemblies for Consolidated-Vultee Aircraft Co.

First Unit Ready for Lockheed's Research Center

BURBANK, Calif.—First unit of Lockheed Aircraft Corp.'s Special Projects center has been completed and work is proceeding on schedule for the remainder. The new plant, whose working area will cover 96,000 sq ft at an initial investment of $600,000, was laid out specifically for construction of prototypes, or first units of a new design.

First plane to be built in the center will be the Air Force XC-130, a military cargo ship, the first pure turbo-prop transport design ever laid down in the United States.

Douglas to Use Chicago Plant For Twin-Jet Bomber

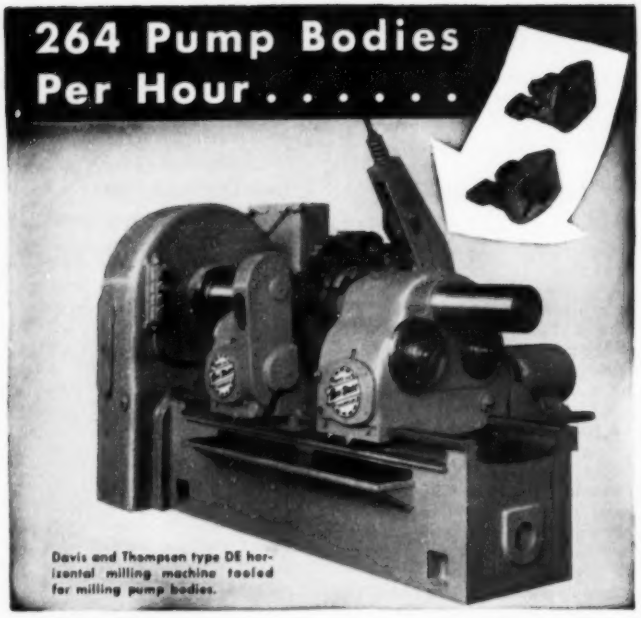
WASHINGTON — The Air Force has granted Douglas Aircraft Co., Santa Monica, Calif., a contract to produce twin-jet reconnaissance planes at O'Hare International Airport, outside of Chicago.

The aircraft company will build the plane, a modified Navy A3D which it designed, in the 2,300,000 sq ft plant where Douglas made C-54 transports during World War II. The Air Force version of the plane has been designated the BD66. It is a swept-wing attack plane, carries a crew of three and flies between 600 and 700 mph. The planes to be built at Chicago will eliminate the folding-wing feature, peculiar to Navy carrier-based planes.

• **Conversion of the plant** will begin immediately, with peak employment estimated to be about 15,000. Douglas did not disclose when production would begin or the number of planes contracted for by the Air Force. It is expected that Douglas will also use the Chicago facilities to produce the Navy model of the plane later in the year.

Previously the O'Hare plant was being used by Fairchild Engine & Aircraft Co., to build the C-119 flying box Car, but this contract was canceled recently when the Air Force de-emphasized their reciprocating-engine production program (*AM*, March 17, '52, p. 219).

264 Pump Bodies Per Hour . . . . . .



Davis and Thompson type DE horizontal milling machine tooled for milling pump bodies.

1-A Standard Horizontal Milling Machine

Oil pump bodies requiring high degree of finish and high production are rough and finish milled on both sides simultaneously with this Davis and Thompson type DE milling machine. Production is 264 pieces per hour.

Patented Angular Spindle Adjustment Allows "Toe Cutting"—Maintains Fine Finish at High Production

The finishing spindle is provided with an exclusive D&T design which allows angular adjustment. This in turn results in "toe-cutting" and eliminates "drag" of the cutter over the finished surface. Both roughing and finishing spindles have micrometer endwise adjustment.

A Basically Standard Machine Employing Roto-Matic Principle For High Production Special Milling

Like all D&T machines this model DE is designed for long life and trouble-free operation. Each head has independent drive. There is backleash take up to mandrel. Anti-friction bearings throughout. Rapid traverse between cuts can be incorporated.

Free Data will be furnished upon request.

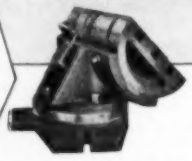
DAVIS and Roto-Matic THOMPSON

Davis & Thompson Company

6411 W. BURNHAM ST., MILWAUKEE 14, WISCONSIN

BOSTON UNIVERSAL ANGLE PLATE

A Precision Tool that Holds Work at Any Desired Angle.



Puts Speed and Profit into Angular Drilling, Milling, Planing, Shaping, Grinding

With a Boston Universal Angle Plate on the job, work is quickly set up on the table and but a few seconds are required to locate it at the desired angle. Indispensable in tool rooms and extremely useful in production runs, the Boston Universal pays for itself many times over by eliminating the necessity of expensive jigs and fixtures.

Horizontal motion is 360 degrees; vertical motion, 120 degrees. Fitted with vernier scale reading to 5 minutes.

Made in several stock sizes.

Write today for full information.

US AUTOMATIC BOX MACHINERY CO., Inc.

40 ARBORETUM ROAD · BOSTON 31, MASSACHUSETTS

Lyon Metal Products to Do Defense Subcontracting

AURORA, Ill.—Lyon Metal Products, Inc., has in progress a plan for doing subcontract work on sheet-metal parts for prime defense contractors. It is similar to the program carried out so successfully during World War II.

Lyon is hit now, as it was then, by curtailment of materials available for production of civilian goods, as ordered by Washington. National Production Authority has limited the amount of sheet metal which Lyon can use for its normal peacetime products. These products range from kitchen and storage cabinets for the home to shelving, lockers, revolving bins, work benches and shop equipment for industrial plants.

To keep its factory facilities and its employees busy, Lyon has put its sales staff to work digging up defense subcontracts. Its district salesmen have been instructed to call on every manufacturer who might have or intend to get a prime government contract. In this way, the management hopes to turn up defense business which will fit its plant and production-equipment facilities and 1600-employee staff.

• **Solicitation of such work** is the salesman's No. 1 job these days. At the most recent general sales meeting of the company, the assembled salesmen were shown films of the kind of war goods made by Lyon as subcontractors to prime contractors. The point was stressed that the company handled 3800 contracts in World War II for aircraft, ordnance, ships, tanks, etc.

Examples of kinds of products made by Lyon: tank-ammunition racks, gun-sight cases, machine-gun cartridge boxes, signal-light cases, hand-grenade boxes, airplane-landing mats, ship lockers, skid bases for power units, aluminum aircraft-ammunition boxes, radio-test cabinets, bomb-sight shipping cases, over 400 parts for the water buffalo truck.

Lyon has put out a brochure (as well as advertising in technical papers) listing its qualifications as a sheet-metal subcontractor. It emphasizes that it has two manufacturing plants, one here at Aurora and another at York, Pa., with a total of 581,000 sq ft of floor space.

SCRAP is easy to find in Denmark. The Danish Steel Rolling Mills in Frederiksvaerk is a big buyer of thousands of tons of war material obtained from the cannons and ammunition of Hitler's Atlantic Wall, the Hansted fortress on the West Coast of Jutland.

Small Shipbuilding Firms Get Navy Barge Contracts

WASHINGTON—The Navy Bureau of Ships has awarded contracts totaling $3,571,000 to three shipyards, classfied as "small business," for construction of 81-ft sectionalized deck-cargo barges to be used by the Army Transportation Corp.

A total of 194 barges will be built by the following: Kargard Boat & Engine Co., Marinette, Wis.; West Coast Machinery, Inc., Stockton, Calif.; and Pidgeon-Thomas Iron Co., Memphis, Tenn.

Navy Shipyards Building Minesweepers and Radar Subs

WASHINGTON—The Navy has issued orders for the construction of two auxiliary minesweepers and two radar-picket submarines. The 138-ft minesweepers (AMS) will be built at the Puget Sound Naval Shipyard, Bremerton, Wash. Detailed working drawings will be prepared by the design agent, Sparkman and Stephens, Inc., New York, who will also act as central procurement agent for all AMS-60 class vessels.

Construction of the submarines has been assigned to the Portsmouth Naval Shipyard, Portsmouth, N. H.

Metalworking Getting 75% of Fast Tax Write-Off Expansion Dollar

WASHINGTON — Metal producers and metal consumers have gotten by far the largest benefits from the government's program of aiding industrial expansion by giving accelerated tax amortization.

As of Feb. 25, expansion chief James F. King of the Defense Production Administration reports that aid has been given to about $14.5-billion of investment. Roughly, about three-fourths of the dollar value of the expansion is capacity that's related directly to metal production.

Biggest single program has been to increase iron and steel capacity: Proposed investment runs to about $2.8-billion, which is 19.3% of all expansion assisted by tax write-off.

• **DPA has processed** about 11,400 applications for the certificates of necessity that permits the fast write-off of part of plant investment. About 7100 have been approvals.

Recently, DPA has been lowering the percentage of the cost of a project that can be written off in five years, and denying more applications. Reason: Much of the expansion the government wanted started is now underway.

Following is the distribution of Certificates of Necessity to phases of Metalworking industry as of Feb. 25:

	No. of Certificates	Investment (Thousand of $)	% of Total
Iron and Steel	542	$2,810,348	19.3
Railroads, other transportation and storage	887	2,576,837	17.7
Aluminum and other non-ferrous metals	176	798,410	5.5
Aircrafts and parts	727	710,621	4.9
Machinery (except electrical) and parts	1088	478,566	3.3
Electrical machinery, equipment and supplies	413	279,338	1.9
Ordnance and supplies	398	225,610	1.5

C & J
Geared-Head
LATHES 16 INCH 12 SPEED

ONLY ONE MODEL • ONLY ONE SIZE

FOR HIGH GRADE PRACTICAL GENERAL SERVICE

- Tooled and equipped for efficient production
- Exceptionally long carriage bearing—23½ in.
- Feed provided by separate rod—lead screw is used only for thread chasing

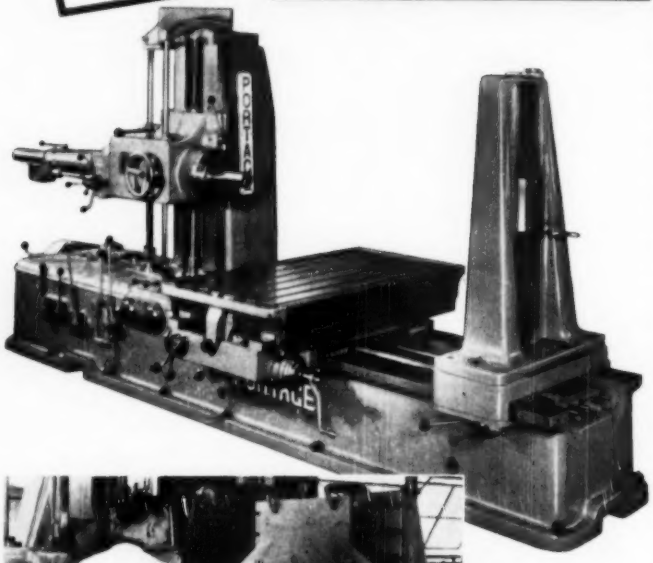
Complete regular equipment includes thread indicator.

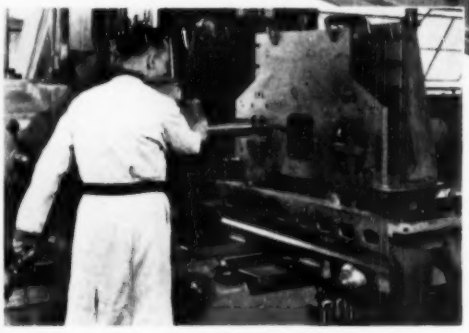
Guaranteed accurate to good commercial standards. Write TODAY for new bulletin 38-A-8.

CARROLL & JAMIESON MACHINE TOOL CO.
BATAVIA, OHIO

Finer Diesel Engine Drill Jigs made on . . .

PORTAGE
HORIZONTAL BORING MILL





This photo, taken at Hygrade Machine & Tool Company, shows the manufacturing of a Diesel engine drill jig for the Cooper-Bessemer Company. Hole spacing is made to an accuracy of plus or minus .0005 through optical measurement with the use of the Scan-a-scope instrument, furnished with PORTAGE machines.

Mr. Otto, President of Hygrade Machine & Tool Company says: "We prefer the PORTAGE because of its dependably fine built-in accuracy". That's why PORTAGE is first choice for horizontal boring, milling and drilling. Write for catalog fully explaining the construction of the PORTAGE and you will understand why it has great in-built accuracy.

THE PORTAGE MACHINE COMPANY
1026 SWEITZER AVENUE Established in 1916 AKRON, OHIO
DEALERS IN ALL PRINCIPAL CITIES

LATEST DEFENSE

ARMY ORDNANCE AWARDS

Tank-Automotive Center, Detroit

Ward La France Truck Corp., Elmira, N.Y.—replenishment of motor-vehicle parts, $125,531.

Bearing Co. of America, Lancaster, Pa.—hardware, $153,569.

Dana Corp., Toledo, Ohio — motor-vehicle parts, $111,888.

Gould-National Batteries, Inc., St. Paul, Minn.—battery, storage $191,366.

Truck & Coach Div., GMC, Pontiac, Mich.—tractor trucks, 10-ton, exceeds $250,000.

Marathon Foundry & Machine Co., Chicago—motor-vehicle parts, exceeds $250,000.

Stewart-Warner Corp. Chicago—replenishment of tools, exceeds $250,000.

Strick Co., Philadelphia—cargo trailer, exceeds $250,000.

Motor Wheel Corp., Lansing, Mich.—tank and combat-vehicle part replenishment, exceeds $250,000.

Chevrolet Motor Div., GMC, Detroit—carryall trucks, exceeds $250,000.

Detroit Ordnance District

Oldsmobile Div., GMC., Lansing, Mich. — rocket assemblies, exceeds $250,000.

Pontiac Motor Div., GMC, Pontiac, Mich.—metal parts for rockets, exceeds $250,000.

Philadelphia Ordnance District

Chrysler Corp., Detroit—tanks T48, exceeds $250,000.

Rheem Mfg. Co., Lester, Pa.—facilities for production, exceeds $250,000.

American Car & Foundry Co., New York—twin 40-mm guns and spare parts, exceeds $250,000.

Worthington Pump & Machinery Corp., Harrison, N.J.—repair parts for pumps, compressors and turbines, $2,039,412.

Dravo Corp., Philadelphia—repair parts for main and auxiliary turbines and reduction gears, $363,748.

ARMY ENGINEER AWARDS

Chicago District Engineers

N. W. Martin & Bros., Inc., Arlington, Va.—winterization kits, $114,006.

Caterpillar Tractor Co., Peoria, Ill.—spare parts, exceeds $250,000.

Standard Products Co., Cleveland—metallic-belt links, 60-cal., $136,710.

Standard Knapp Div., Emhart Mfg. Co., Portland, Conn.—bulletin assembly attachments, $221,760.

Kwikset Locks, Inc., Anaheim, Calif.—metallic-belt links, 30 cal., exceeds $250,000.

Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.—assembly machines, various types, exceeds $250,000.

ARMY SIGNAL CORPS AWARDS

Philadelphia Supply Agency

Soundscriber Corp., New Haven, Conn.—transcriber, exceeds $250,000.

Traveler Radio Corp., Chicago—mountings, exceeds $250,000.

Automatic Mfg. Co., Newark, N.J.—power supply, exceeds $250,000.

Victoreen Instrument Co., Cleveland—radiacmeter, exceeds $250,00.

Western Electric Co., Inc., New York—transistors, $240,000.

York-Hoover Corp., York, Pa.—shelter, exceeds $250,000.

Kings Electronics, Tuckahoe, N.Y.—mountings, exceeds $250,000.

Delco Radio Div., GMC, Kokomo, Ind.—receiver-transmitters, exceeds $250,000.

subcontracting NEWS

CONTRACTS

Maspeth Telephone & Radio Corp., Brooklyn, N.Y.—relays, exceeds $250,000.

Atlantic Hardware & Supply Corp., New York—tool equipment, exceeds $250,000.

U. S. Trunk Co., Fall River, Mass.—chests, exceeds $250,000.

Western Electric Co., Inc., New York—service test model telephone central office set, exceeds $250,000. Transistors, $240,000.

Bomac Labs, Inc., Beverly, Mass.—production facilities, $155,571.

American Television Mfg. Corp., Chicago—production facilities, $183,624.

General Electric Co., Schenectady, N.Y.—production facilities, exceeds $250,000.

Alloy Metal Wire Co., Prospect Park, Pa.—production facilities, $203,000.

Raytheon Mfg. Co., Waltham, Mass.—radar set, exceeds $250,000, and maintenance parts exceeds $250,000. Two contracts.

David Bogen Co., Inc., New York—public-address sets and maintenance parts, exceeds $250,000.

Hallicrafters Co., Chicago—radio sets, $113,763.

Emerson Radio & Phonograph Corp., New York—radio set, exceeds $250,000.

Sentinel Radio Corp., Evanston, Ill.—radio set, exceeds $250,000.

NAVY AWARDS

Navy Purchasing Office Washington 25, D.C.

Carlton Machine Tool Co., Cincinnati—radial drills, $133,925 and $110,670 (two contracts).

Reliance Machine & Tool Div., Guide-Instrument & Machine Inc., New York—lathes and tools, exceeds $250,000.

Lodge & Shipley Co., Cincinnati—motor-driven lathes, $131,605.

Bureau of Ships, Washington 25, D.C.

Badger Mfg. Co., Cambridge, Mass.—compressors, distilling unit, $314,740.

Stoddart Aircraft Radio Co., Hollywood, Calif.—test set, $700,836.

Teletype Corp., Chicago—teletypewriter test sets, $136,112.

National Union Radio Corp., Orange, N.J.—dark trace cathode-ray tube, $154,500.

David Bogen Co., Inc., New York—teletype terminal equipment, $222,316.

Modern Metal Crafts Co., Inc., Philadelphia—service lockers, $371,714.

George G. Sharp, Inc., Jersey City, N.J.—maritime administration cargo ships. No figure available.

Radio Corp. of America, Camden, N.J.—transducers, $270,253.

I.T.E. Circu't Breaker Co., Philadelphia—paralleling switchboard, $147,785.

Bogue Electric Mfg. Co., Paterson, N.J.—motor generator sets, $388,209.

Stoddard Aircraft Radio Co., Hollywood, Calif.—radio-interference and field-intensity measuring equipment, $655,872.

Gibson Refrigerator Co., Greenville, Mich.—facilities for 75-mm shells, exceeds $250,000. 75-mm HE shells, exceeds $250,000. Two contracts.

Ternstedt Div., GMC, Livonia, Mich.—range finders, exceeds $250,000.

Bureau of Ordnance, Washington 25, D.C.

M. W. Kellogg Co., Jersey City, N.J.—plant equipment, $1,080,500.

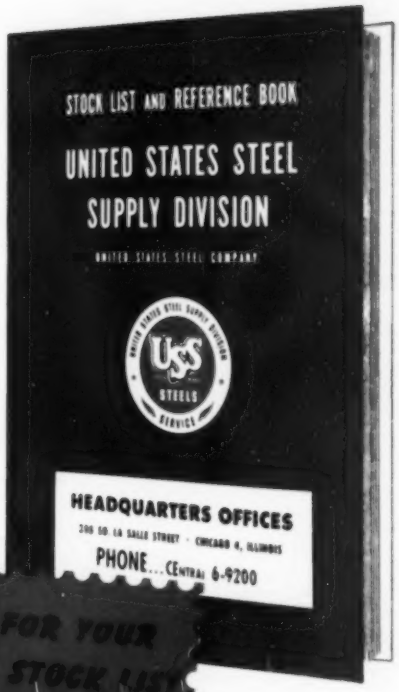
Stabot Heater Corp., Brooklyn — dummy cartridges, $340,050.

Kearfott Co., Inc., Little Falls, N.J.—Servo motors, $169,349.

Bell Aircraft Corp., Buffalo — production facilities, $297,991.

(Continued next page)

FOR QUICK, ACCURATE STEEL SELECTION



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UNITED STATES STEEL

NAVY AWARDS . . . . . continued

Switlik Parachute Co., Inc., Trenton, N.J.—air stabilizers, $117,000.

Irvins Air Chute Co., Inc., Buffalo, N.Y.—air stabilizers, $114,934.

C. B. Cottrall & Sons Co., Westerly, R.I.—rocket motors, $3,032,000.

International Resistance Co., Philadelphia—plant equipment, $1,247,655.

NAVAL AVIATION AWARDS

Bureau of Aeronautics, Washington, D.C.

Philco Corp., Philadelphia—production facilities, $140,250.

ACF-Brill Motors Co., Hall Scott Motors Co., Berkeley, Calif.—production facilities, $102,093.

Greer Hydraulics, Inc., Brooklyn — portable hydraulic test stands, $144,560.

Philadelphia Supply Office

Regent Mfg. Co., Downey, Calif.—tripod jacks, $112,154.

Wolfe & Mann Mfg. Co., Baltimore, Md.—aircraft platform, $197,416.

Scintilla Magneto Div., Bendix Aviation Corp., Sidney, N.Y.—maintenance parts, $121,-586.

Scaffold Equipment Co., Pittsburgh—aircraft servicing platforms, $101,694.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N.J.—generators and regulators, $161,422. Control, barometric-altitude, $107,-262.

Mead Aviation Equipment Co., Inc., Trenton, N.J.—safety belts, $158,092.

AiResearch Mfg. Co., Div., Garrett Corp., Los Angeles—refrigeration units, $150,406.

Taunton Engineering Works, Taunton, Mass.—mobile mast, exceeds $250,000.

National Broach & Machine Co., Detroit—external gear shaver, exceeds $250,000.

Redco Tool Div., Red Lion Cabinet Co., Red Lion, Pa.—hoist assembly, exceeds $250,00.

W. L. Maxson Corp., New York—maintenance parts, $171,403.

Vickers, Inc., Div. Sperry Corp., Detroit—pump and motor assemblies, $107,183.

Douglas Aircraft Co., Inc., Santa Monica, Calif.—maintenance parts, exceeds $250,000.

Henry Spen & Co. Inc., Brooklyn, N.Y.—oxygen trailer, $243,375.

Continental Aviation Engineering Corp., Detroit—maintenance parts, $242,738.

Walworth Co., New York—valves, gate and globe, $154,533.

Northern Indiana Brass Co., Elkhart, Ind.—valves, $167,058.

Jordan Refrigerator Co., Inc., Philadelphia—refrigerators, shipboard, $187,962.

AIR FORCE AWARDS

Air Material Command Wright Patterson AF Base, Dayton

General Electric Co., Utica, N.Y.—machinery and equipment, $1,250,000.

Reynolds Metals Co., Richmond, Va.—aircraft forgings, $12,675,000.

Consolidated Industries, Inc., Lafayette, Ind. tank assemblies, $960,000.

Electric Storage Battery Co., Cleveland — storage batteries, $128,000.

Westinghouse Electric Corp., Dayton—alternators, voltage regulators, $561,262, and $563,-791. Two contracts.

Fairchild Camera & Instrument Corp., Jamaica, L.I., N.Y.—K-38 aircraft cameras, $100,-000.

Republic Aviation Corp., Farmingdale, L.I., N.Y.—F-84X airplanes and spare parts, $8,000,-000.

Mosler Safe Co., Hamilton, Ohio—office safes, $264,108.

Mall Tool Co., Chicago—generator sets, $1,-959,439.

American Fixture & Mfg. Co., St. Louis, Mo.—chairs, $329,754.

Eleven Production Pools Now Approved by DPA

WASHINGTON — The Defense Production Authority has approved three additional defense production pools for handling prime and subcontracts, bringing to eleven the number authorized during the present emergency.

The complete list, to date, follows:

Omaha Industries, Inc., Omaha, Neb.—100 firms.

Coordinated Mfrs. of Santa Clara Country, Inc., San Jose, Calif.—45 companies.

Peoria Consolidated Mfrs. Inc., Peoria, Ill.—19 concerns.

Greater N. Y. Manufacturing Pool, New York—77 firms.

Central California War Industries, Inc., Fresno, Calif.—22 companies.

Illinois Mfrs. Defense Pool, Inc., Chicago—29 firms.

Dade County Industries, Inc., Miami, Fla.—7 concerns.

Small Manufacturers Cooperative, Bridgeport, Conn.—5 companies.

Specified Finishes, Inc., Chicago—7 companies.

Mil-Fin, Inc., Waukegan, Ill.—5 companies.

Florida Wood Cooperative, Miami, Fla.—14 firms.

Navy's Distinguished Public Service Award was presented by Secretary Dan A. Kimball to Robert F. Nelson, executive vice president, American Type Founders, at a recent Pentagon ceremony. Mr. Nelson was cited for work with the Arma Corp., in developing gun-fire controls, torpedo controls and other instruments during World War II. Left to right, Capt. R. L. Adams, BuOrd; Sec. Kimball; Mrs. Nelson; Mr. Nelson; T. R. Jones, board chairman, ATF; and Admiral H. D. Baker, chairman, Ships' Characteristics Board

Parker Appliance Co., Cleveland—machinery and equipment, $2,200,000.

Weston Electrical Instrument Corp., Newark, N.J.—indicator, $110,359.

Fairchild Camera & Instrument Corp., Jamaica, L.I., N.Y.—cameras $100,000.

Leland Electric Co., Dayton, Ohio—inverters, $651,305.

Peer, Inc., Benton Harbor, Mich.—welders, $266,380.

Waco Aircraft Co., Troy, Ohio—dome assemblies, turret, $105,738.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.—wheel and brake assembly, $1,031,792.

Fairchild Engine Div., Fairchild Engine and Airplane Co., Farmingdale, L.I., N.Y.—power plants, $2,235,180.

Lewis Engineering Co., Naugatuck, Conn.—temperature indicators, $181,186 and $205,257. Two contracts. Leads, thermocouple, $137,604.

Delta Power Tool Div., Rockwell Mfg. Co., Milwaukee, Wis.—saw, band woodworking, $137,917.

Eagle Electric Mfg. Co., Inc., Long Island City, N.Y.—telegraph, repeater, $127,103.

South Bend Lathe Works, South Bend, Ind.—lathes, $609,730.

Jack & Heintz, Inc., Cleveland — starters, $1,682,101. Generators, $1,109,347.

Seifreat Elstad Machinery Co., Dayton—milling machines, $1,071,766.

C. H. Gosiger Machinery Co., Dayton—lathes, $977,321.

Cincinnati Lathe & Tool Co., Cincinnati—lathes, $564,989.

Houston-Fearless Corp., Los Angeles—processing machine, $1,026,509.

Sampsel Time Control Inc., Spring Valley, Ill.—power units, $2,491,445.

Federal Telephone & Radio Corp., Clifton, N.J.—transformer rectifiers, $106,627.

Oliver Corp., Chicago—fuselages, $512,000.

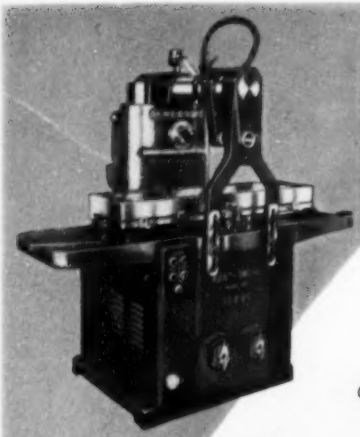
Consolidated Vultee Aircraft Corp., San Diego, Calif.—kits, modification, $112,234.

Jniversal Standard Drill Bushings with **super finish I.D.** lengthen the bushing life . . . reduce tool breakage . . . slash drill wear. Then, add the plus features of blended radius, knurled head, I.D. break, chamfered O.D., and you have the reasons why Universal Drill Bushings are specified by many of America's largest manufacturers. All catalog sizes are available for immediate shipment. Extra prompt sectional delivery and information are provided by warehouses at 1060 Broad Street, Newark, New Jersey, and 5035 Sixth Ave., Kenosha, Wisconsin. Write, call or wire today!

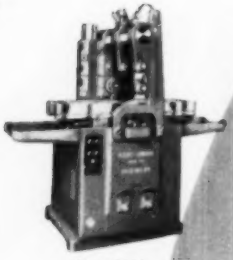
[redacted]

Facilities available for special hardened and ground precision parts made to customer specifications.

Mill it Faster with
KENT-OWENS

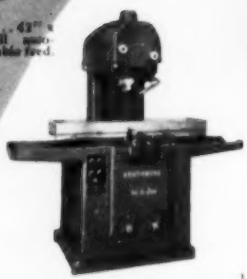


No. 2-30
20" table travel . . . 42" x 12" table . . . full automatic hydraulic table feed.



No. 2-20DS.
Double Spindle for two milling operations at same time . . . 20" table travel . . . 42" x 12" table.

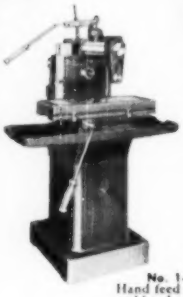
Do your milling jobs *right*—with Kent-Owens Milling Machines! Designed with advanced features that mean outstanding *speed*, *accuracy* and *dependability* . . . Ruggedly constructed to maintain accuracy under hard use. Twin-post head mounting—an exclusive Kent-Owens feature—assures balanced load, no chattering. Simple in design and operation. Saves labor . . . reduces costs! Write for bulletins on wide range of hydraulic and hand-operated machines. Kent-Owens Machine Co., Toledo, Ohio.



No. 2-20V.
20" table travel . . . vertical spindle with speed range 32 to 1284 R.P.M. . . . 42" x 12" table.

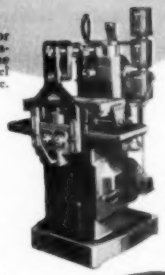
No. 1-14.
32" x 9" table . . . 14" table travel . . . hydraulic table feed . . . full automatic cycle.

No. 1-14DS.
Double Spindle for two milling operations at same time . . . 14" table travel . . . 32" x 9" table.



No. 1-M.
Hand feed to table and head . . . 25" x 9" table . . . Adjustable head counter-balance.

No. 1-V.
Hydraulic vertical head feed . . . 5½" head travel . . . 25" x 9" table.



No. 1-8.
8" table travel . . . 25" x 9" table . . . automatic hydraulic table feed.

KENT-OWENS REPRESENTATIVES

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BUFFALO
Don W. Patterson

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DALLAS
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WALKERVILLE, ONT.
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CALL ON KENT-OWENS FOR MILLING MACHINES

What's in Vermont this month?

NEW SLIDES ELIMINATE OIL FILM BEARING. Bryant has developed a preloaded ball bearing slide for their internal grinders that is unique in both construction and performance. It comprises sleeves with rows of ball bearings that provide rolling metal-to-metal contact. It forms an extremely sensitive, yet rigid, mounting.

Two of these bearings on one bar maintain axial alignment; a third bearing on another bar gives the slide a widely spaced, three-point support. The Bryant slide resists all lateral thrust since preload is radial. This design avoids the objectionable feature of conventional slides in which the oil film causes a slight flotation resulting in slight misalignment of the members.

One slide under the workhead and one under the wheelhead eliminate a compound slide and keep the workhead and wheel near the bed of the machine for maximum rigidity.

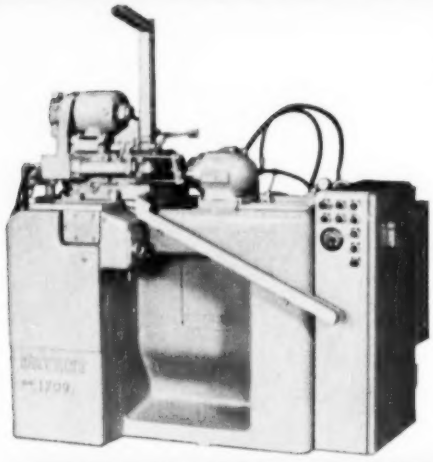
This design was planned for exclusive use on machines of the "high precision" class where a shift of 20 millionths of an inch due to oil film would result in work spoilage.

The design has proved so successful, where fast stock removal and extremely close tolerances are required, that this slide is now standard on the Bryant No. 1209 Automatic.

This is an example of how new basic design in modern machine tools can increase your precision production.

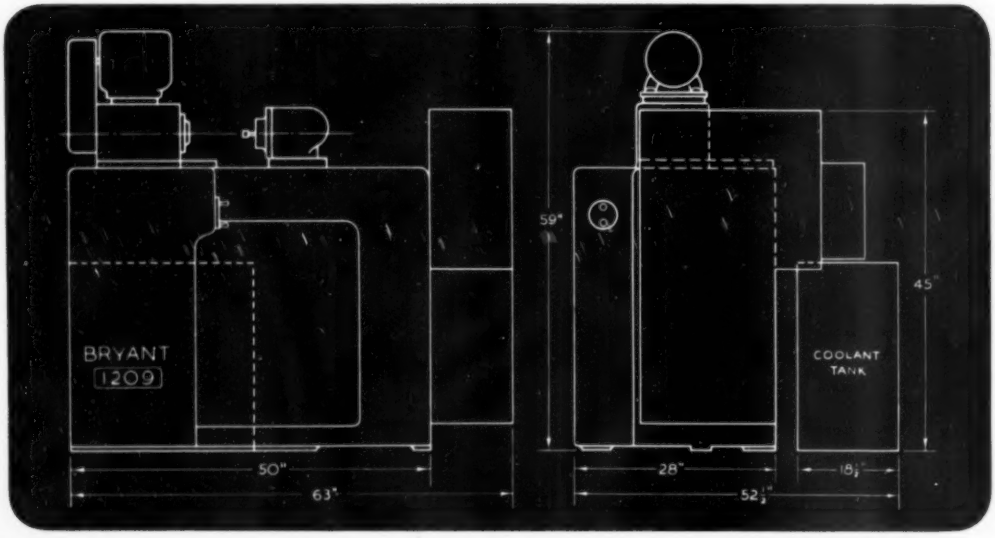
Bryant Chucking Grinder Company in Springfield, Vermont, U.S.A.

FOR HOLE GRINDING

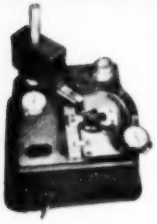


The Bryant 1209 Automatic Hole Grinder

This machine is designed particularly for high production, precision grinding of bores from ¼" to 3" in ball bearing races, gears, rolls, bushings, etc. Operator merely loads work, trips a valve to start cycle, and unloads the finished piece. The machine automatically *rough grinds, finish grinds and returns to chucking position when finish size is reached.* Hydraulic control, with individual throttles, gives infinitely variable control for each phase of the grinding cycle. The work spindle and cross feeds are driven by independent D. C. motors, giving infinite speeds and feeds with dial control. Wheel speeds up to 100,000 R.P.M. are obtained with the Bryant Hi-Frequency Wheelhead. Write for folder.



FOR CHECKING SQUARENESS OF UNDER-FACE

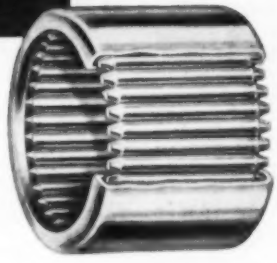


Bryant Thread Gage with Squareness-of-under-face Attachment

When an under-face must be checked square with an external thread, the part should be held on the thread flank and rotated in this position. The Bryant Gage does this, regardless of variation in roundness, P.D., lead or thread form. The attachment can be adjusted to check the under-face of any part which can be held in the gage. Illustrated is the No. 2 gage with a range from 1" P.D. to 2½" P.D. Simultaneous readings can be made — the attachment shows face run-out — the Bryant Thread Gage checks thread size — *giving accumulated reading of P.D., form and lead on dial indicator 4 to 5 times faster than plug gaging.* Send for folder.

Bryant Chucking Grinder Company in Springfield, Vermont, U.S.A.

david tames goliath . . .



Torrington Needle Bearings are small—but mighty! A full complement of precision-ground rollers distributes loads evenly over an extra-large area . . . providing greater radial capacity in relation to O. D. than any other type of anti-friction bearing.

This high capacity, combined with compact size, has helped improve the efficiency of many products. So have other Needle Bearing advantages—light weight, easy lubrication and long service life. Ask our engineers to give you the whole story on Torrington Needle Bearings in terms of *your* product!

THE TORRINGTON COMPANY

Torrington, Conn. South Bend 21, Ind.

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TORRINGTON *NEEDLE* BEARINGS

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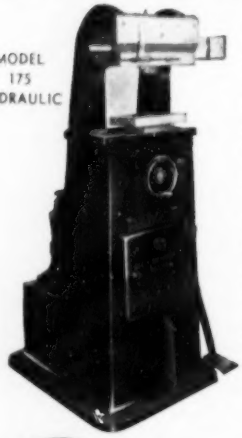

Identification ROLLED into your products will help you market them.

Hack Saw blade above has been permanently marked in a Model 175 Hydraulic Marking Machine using a solid engraved lettering knurl.

Your name, model number, part number, serial number or decorative designs can be rolled into your components to improve their appearance and facilitate identification.

Send prints of parts, showing required marking and its location on part with hourly production for free recommendation.

WRITE FOR CATALOG

GTS **GEO. T. SCHMIDT, INC.**
1810 W. BELLE PLAINE AVENUE
CHICAGO • 13 • ILLINOIS

From the *American Machinist* Library of *Tips for Top Shop Men*

DON'T flaunt your greater income or privileges before your subordinates. No matter how much they like you, their resentment and envy will do you more harm than the flaunting does your ego good.

REMEMBER that human problems need careful study just as do engineering problems. Man is multi-motivated and one prescription won't cure all his ills.

BE suspicious of any figures you hear, and of most of those you see. If they don't correspond immediately to your previous experience, check 'em before you quote or use 'em. The urge to make numbers bigger, or smaller than anything previously reported is overpowering to some people; don't be victimized.

How efficient is YOUR shop?

Over 42 per cent of metalworking production equipment is now over ten years of age . . . 19 per cent of it was bought more than 20 years ago!

This means that there is more over-age and obsolete production equipment operating in metalworking shops now than in 1945, and the rate of obsolescence is growing.

How about your shop? Are you equipped adequately with the modern, high-efficiency machinery and equipment which alone can produce the better products that cost *less to buy* which everybody wants? How does your shop compare with those of your competitors, and with metalworking shops generally?

You can find out quickly by writing for a copy of the *American Machinist* Mid-Century Inventory of Metalworking Production Equipment. Here are all the facts on the age and number of 155 major types of production equipment, operating in 15 manufacturing divisions and 25 major production areas. Price: $2.00 per copy.

American Machinist

Reader Service Department

McGRAW-HILL BUILDING
NEW YORK 36

NEW Identification Chart Helps Stainless Steel Users 3 Ways . . .

1

Separating Stainless Scrap: Use this chart to quickly segregate Stainless steel scrap for salvage . . . thus making the scrap more usable for industry, and increasing its value to you.

2

"Unscrambling" Mixed Stainless Stocks: The chart can help you save time getting Stainless stocks in order and reduce the danger of your men using the wrong Stainless for the job.

3

Preventing Trouble On The Job: If there is reasonable doubt as to the identity of the steel, use the chart before starting a job to double-check the type of Stainless to prevent troubles that could be caused by wrong treatment in fabrication.

Any user of Stainless steels will find this new Carpenter Identification Chart can save time, money and shop headaches by providing a quick method for identifying Stainless steels. The chart tells how to prepare the samples . . . then diagrams and explains fully how to use each of eleven different tests for identifying various Stainless types. Typical reactions are given for the nitric acid, magnet, spark, hardness, muriatic acid, sulphur spot, nickel spot and stabilization tests. Measuring 11" x 22", the chart is convenient to use right on the testing table. Carpenter offers this handy chart free to Stainless steel users. No obligation . . . just drop us a line on your Company letterhead. THE CARPENTER STEEL CO., 109 W. Bern St., Reading, Pa.

It is assumed that the operator making the tests described in this Identification Chart will have some technical knowledge of the various alloys involved. The tests are not designed to supplant chemical analysis, but they are useful in separating various Stainless types that show marked differences in their chemical and physical properties.

Carpenter
STAINLESS STEEL
takes the problems out of production

Custom Made to work in quiet harmony through a longer lifetime.
Precision finished to your specifications, constantly tested for accuracy and silent operation, Cincinnati Gears are made to render trouble-free service over longer time-spans.

Made for each other

*Reg. U. S. Pat. Off.

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"Gears Good Gears Only"
Wooster Pike and Marlemont Ave. • Cincinnati 27, Ohio

an ACCO product

J-Model "ROCKWELL" Hardness Tester

5 Important "ROCKWELL" Features

1. Totally enclosed, dirt and dust-proof "Zerominder" dial gauge. 2. Gripsel clamp screw for quick change and proper setting of penetrator. 3. All controls grouped conveniently. 4. Enclosed, easy-to-reach, variable speed dash pot. 5. Standardized weights. These features assure accuracy and ease of operation.

There are two models of WILSON "ROCKWELL" Hardness Testers, plus the TUKON for micro-indentation hardness testing. Write for information.

ACCO *Trade Mark Registered

WILSON MECHANICAL INSTRUMENT DIVISION
AMERICAN CHAIN & CABLE
230-x Park Avenue, New York 17, N. Y.

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Automatic Dieing Machines combine high speed with long die life in production of metal stampings.

See pages 82-83
March 3rd, American Machinist

HENRY & WRIGHT *Division of Emhart Mfg. Co.* HARTFORD, CONN.

CAMS

BLAIR TOOL & MACHINE CORP.
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ALVORD-POLK TOOL CO. Millersburg, Pa.

above • Looking down inside you see gears ready for shot-peening and spiral conveyor which returns used shot

right • Front view with lid raised showing other gears to be shot-peened

Shot-Peening is a method of toughening gears to make them wear longer. BRAD FOOTE'S shot-peening machine, one of the largest ever made, bombards the gear with shot under pressure. As each shot strikes it compacts the metal and hardens a minute area of the gear's surface.

• Shot-peening is another service which BRAD FOOTE has available for improving the quality of gears you buy for use in your own shop... or on the equipment you make for others. It is another step in our complete gear manufacturing process which means that *"no one shares our responsibility."*

BRAD FOOTE GEAR WORKS, INC.

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subsidiaries | **AMERICAN GEAR & MFG. CO.** • Phone: Lemont 920 • Lemont, Illinois | **PITTSBURGH GEAR COMPANY** • Phone: ATlantic 1-9950 • Pittsburgh 22, Pennsylvania

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PACKAGED
WATER CHILLERS

Now — a compact, completely self-contained water chilling unit for a host of industrial and retail liquid cooling tasks. Rugged Typhoon engineering features include spray nozzles that require no cleaning, insulated water jacket, oversize all-copper condensers and cooling coils. Use these units singly (sizes to 20 tons) or in multiple units to meet any tonnage requirement. Easy to install, outstanding for trouble-free performance and long-life.

COOLS LIQUIDS FROM WATER TO WINE!

TYPICAL TYPHOON WATER CHILLER APPLICATIONS

- **CHILLED WATER** for year-round air conditioning with remote air handling units.
- **COOLING CUTTING OILS** and other liquids for industrial purposes.
- **CHILLED WATER** for drinking fountains.
- **COOLING OF WINE** or other liquids in bottling plants.

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H&G Insert Chaser DIE HEADS

famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

THE EASTERN MACHINE SCREW CORP., 70-40 Barclay St., New Haven, Conn.
Pacific Coast Representative: *A. C. Berbringer, 334 N. San Pedro St., Los Angeles, California.* Canada: *F. F. Barber Machinery Co., Toronto, Can.*

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WALTHAM SUB-PRESSES...
. . . for precision work

Arch Sub-Press

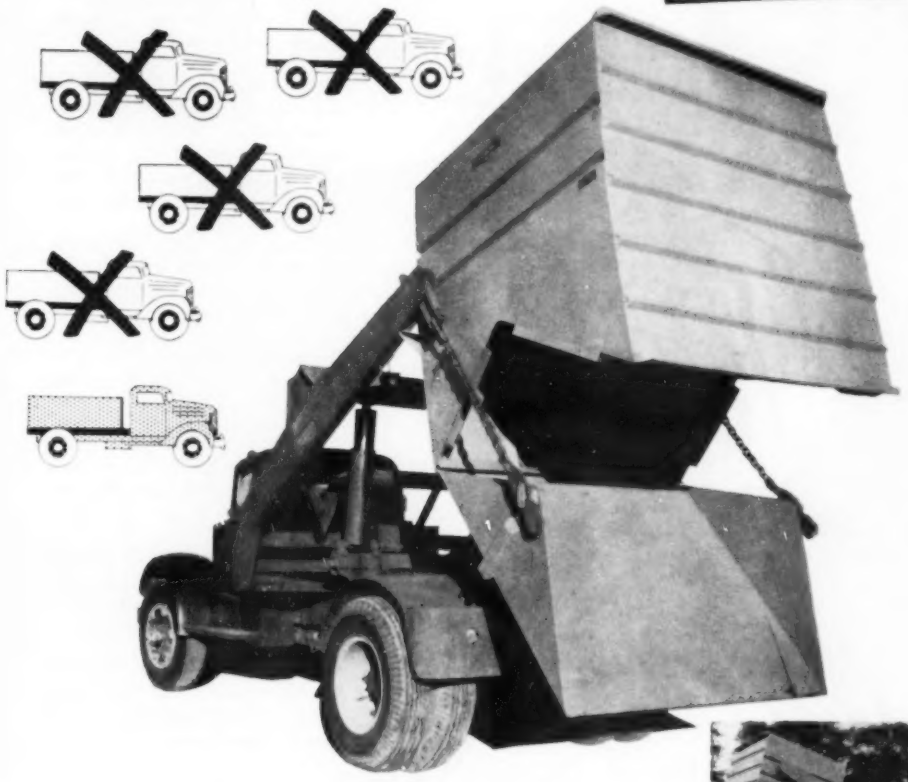
The cylindrical plungers in the Waltham Sub-Presses slide in babbitted bearings. This bearing is tapered on the outside and can be forced downwards, thus reducing the inside diameter to fit the plunger when the latter becomes worn through use. Exact alignment and constant precision can be maintained throughout the life of the die. Write for information about the nine sizes.

Overhang

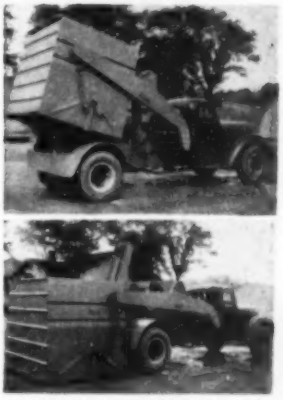
WALTHAM MACHINE WORKS
HIGH STREET, WALTHAM, MASS.

You Can Do The Work of 3 to 5 Conventional Trucks With Only One

DEMPSTER DUMPSTER



In many plants handling materials by the Dempster-Dumpster System, one truck-mounted Dempster-Dumpster, operated by only one man, the driver, has replaced 3 to 5 conventional trucks and crews. One Dempster-Dumpster services a multiple number of detachable containers in a wide variety of designs best suited to the type of materials handled—be they bulky, light or heavy . . . solids or liquids . . . trash or rubbish. Containers are conveniently located at accumulation points inside and outside buildings. The Type LFW Dempster-Dumpster shown above handles containers up to 12 cu. yds. Containers up to 21 cu. yds. are available with our Type ARLF and DTLF Dempster-Dumpsters. Without question, the Dempster-Dumpster System is the most economical and most efficient method of plant materials handling by truck yet devised! Write today for complete information. Manufactured exclusively by Dempster Brothers, Inc.



DEMPSTER-DUMPSTER, operated by means of hydraulic controls in cab, picks up each container, hauls and empties it or sets load down intact.

DEMPSTER BROTHERS, 432 Dempster Bldg., Knoxville 17, Tennessee

It's time we got *working* mad!

As we listen to the latest insults from Moscow, we're likely to get fighting mad.

Instead, we'd better use our heads and get *working* mad.

It is clear by now that Stalin and his gang respect just one thing—strength. Behind the Iron Curtain they've been building a huge fighting machine while we were reducing ours. Now we must rebuild our defenses—*fast*.

As things stand today, there is just *one* way to prevent World War III. That is to re-arm—to become strong—and to stay that way!

This calls for better productivity all along the line. Not just in making guns, tanks and planes, but in turning out civilian goods, too.

Arms must come first. But we must produce arms *at the same time* we produce civilian goods.

We can do this double job if we all work together to turn out more for every hour we work—if we use our ingenuity to step up productivity.

All of us must now make sacrifices for the common good. But we're working for the biggest reward of all —*peace with freedom!*

THE BETTER WE PRODUCE THE STRONGER WE GROW

A PUBLIC SERVICE PROJECT · THE ADVERTISING COUNCIL ·

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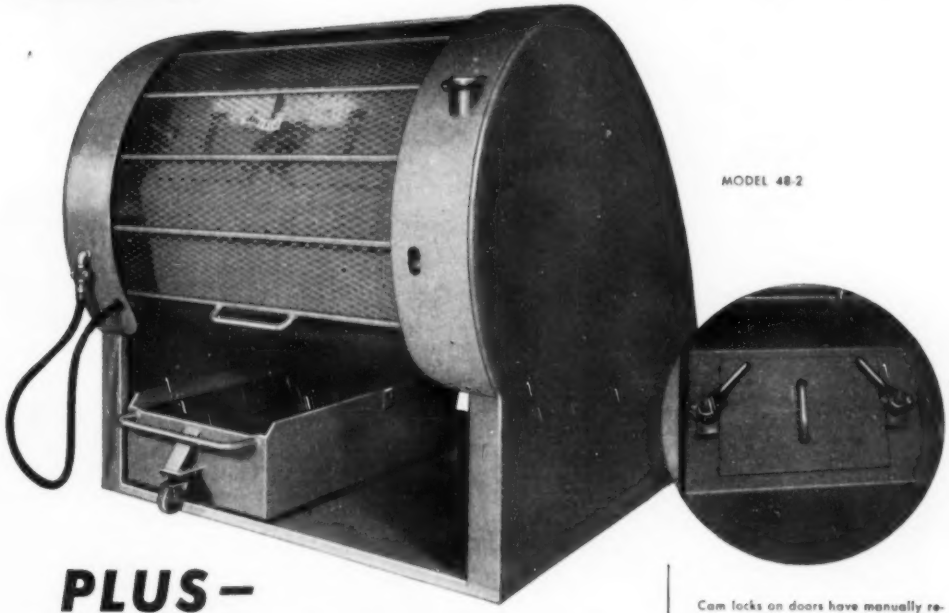
31% to 80% MORE WORK-LOAD-

than comparable tumbling machines occupying the same floor space!



MODEL 48-2

PLUS—

a 15% to 25% shorter cutting cycle!

Grav-i-Flo Tumbling Machines are designed to produce more work in less floor space. That's why so many companies have chosen Grav-i-Flo to handle all their tumbling needs. These manufacturers have compared Grav-i-Flo to other tumbling machinery and have found—First: that Grav-i-Flo machines, in each model, occupying the same floor space, have a 31% to 80% greater capacity; Second: that Grav-i-Flo machines cut from 15% to 25% faster; Third: this shortened processing cycle permits reduction in the required number of machines for an installation, thus benefiting capital investment, floor space and production time; and, Fourth: Grav-i-Flo tumbling machines in all models have such exclusive features as advanced design on door locks and safety guards, and cylinder removal for easier maintenance.

Cam locks on doors have manually released safety stops for pressure relief.

New Grav-i-Flo machines available in a number of models to meet all tumbling requirements. Compartments furnished ⅛" plate unlined or ¼" plate rubber lined. Reduced voltage control on magnetic starter. Lever or push-button switch. Limit switch on safety guard. 220-440 volt, 3 phase, 60 cycle motor with magnetic brake. Water attachment with hose. Counterbalanced safety guard. Hoist pan has tubular yoke with manually operated lock.

TUMBLE GRAV-I-FLO FINISH

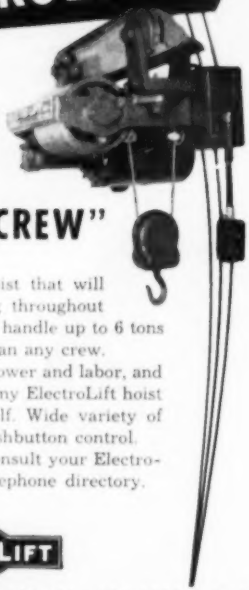
Motor Driven Separator—welded frame supports hoist pan. Separating screen, adjustable from 0" to 1½", accomodates various sizes and types of parts. Screen inclined 5° maximum. Pan shelf provided for stock pan. 1 H.P., 220-440 volt, 3 phase, 60 cycle motor with speed reducer, and manual starter with overload protection.

Samples Processed Free! The Grav-i-Flo Sample Processing Department will gladly tell you how to attain a better finish at lower costs. Send samples direct to The Grav-i-Flo Corporation.

THE GRAV-I-FLO CORPORATION

Dept. AM3B, 400 Norwood Ave., Sturgis, Michigan

ELECTROLIFT



your

"ONE MAN CREW"

Here's a worm drive hoist that will speed materials handling throughout your plant. *One man* can handle up to 6 tons faster and more safely than any crew.

With savings in time, power and labor, and prevention of accidents, any ElectroLift hoist will quickly pay for itself. Wide variety of models, with optional pushbutton control.

For further features, consult your ElectroLift representative in telephone directory.

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ELECTROLIFT, INC., 30 CHURCH ST., NEW YORK 7, N. Y.

your best buy in modern milling machines:

GREAVES NO.2-H

Plain or Universal

- **Offers every modern milling machine advantage:** 18 spindle speeds 25 to 1250 rpm, 18 feeds ½" to 30" per minute, rapid traverse. Timken bearings and many others.

You can't buy a better combination of simplicity, rugged construction, ease of operation, accuracy and production speed.

Send for bulletin and price list.

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FOR OVER 50 YEARS
MOLINE "Hole-Hog"
SPECIALLY DESIGNED
MACHINE TOOLS
HAVE CUT PRODUCTION COSTS
FOR AMERICAN INDUSTRY

MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS

DRILLING
BORING
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Special Machines

DAVIS KEYSEATER

This low cost machine will handle internal keyseating jobs up to 1 in.

Write for illustrated bulletin.

DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

Precision power presses and feeds in a wide range of types and sizes to meet every requirement.

See Pages 60-61 March 3rd, American Machinist

THE V & O PRESS CO. *Division of Emhart Mfg. Co.* HUDSON, N. Y.

You Need an Extra Hand Now to Speed Up Production!

HEIMANN TRANSFER SCREW SETS

IN 11 SIZES No. 6 to 1" N.C. In all S. A. E. sizes.

Here is the faster, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench—no other tools needed. Get more work now—save money too!

HEIMANN MFG. CO. • URBANA, OHIO

TAFT-PEIRCE

Precision Gage Blocks

are built

for Lasting Accuracy

Set 87A provides all dimensions from .200" to 12.000" in steps of .0001", and from .300" to 12.000" in steps of .00005".

Set 35A provides all dimensions from .300" to 8.000" in steps of .0001".

Tungsten Carbide Wear Blocks add more years to the life of your gage block sets. Manufactured in two sizes . . . 0.050" and 0.100" . . . they can be wrung to any gage block combination.

To maintain the ultimate in accuracy — you can rely on these Taft-Peirce Precision Gage Blocks. They're lapped to the highest degree of flatness — carefully hardened for wear resistance — and treated to eliminate seasonal changes. Easily handled. Instantly identified by large size-markings on the sides. You'll find no finer gage blocks to keep your quality control standards dependably right.

Available in single blocks or sets. Write today for more information.

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Branch offices in all principal cities

T-P means TOP PRECISION

Have you heard about

THE LUBRICANT OF MANY USES

Moly-sulfide

A LITTLE DOES A LOT

In the shop—

In the field

Moly-sulfide is a newly-introduced solid-film lubricant, highly successful in applications involving extreme pressures, high velocity, fretting, elevated temperatures and other difficult frictional conditions. We have compiled detailed records of 154 different applications of molybdenum sulfide to actual shop and field problems—some of which might be similar to your own.

Shopmen, engineers, lubrication specialists—write now for a copy of this new 40-page booklet.

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AM-3 MS4

Uniform Rake Angles on Taps Can Save You Money

The importance of rake angles on milling cutters, lathe, planer, and shaper tools has been recognized for many years. Yet the importance of uniform rake angles on the cutting edges of taps is frequently overlooked.

ADVANTAGES OF UNIFORM RAKE ANGLES

Case history studies in plant after plant show that rake angles that stay the same —after many repeated sharpenings—provide much greater accuracy and uniformity in work produced. They also result in greater production per tap and big savings in tap costs.

THE ROLE OF BLAKE EQUIPMENT

The Blake Flute Grinder and Blake Chamfer Grinder are the only machines which enable you to control accurately the rake angle of any tap. By using these two machines, you can duplicate a rake angle which was found previously to be satisfactory. The same rake angle also can be given to as many other taps as desired.

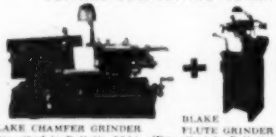
BLAKE EQUIPMENT IS DESIGNED FOR PRECISION! Photograph shows construction of crank shaft unit of chamfer grinder workhead which helps make precision sharpening possible.

THE MONEY-SAVING STEP IS YOURS

You have the opportunity to greatly increase your production per tap and sharply reduce your tap costs by using the Blake precision sharpening method in *your* plant. To get more facts on the subject, write us for the interesting *Machinery* article, "Why Taps Should Be Sharpened Precisely". Illustrated bulletins on both Blake machines are also yours for the asking.

IT'S A FACT! YOU CAN REDUCE YOUR TAP COSTS 50 to 75% by installing Blake tap sharpening equipment and sharpening your taps as you do other metal cutting tools.

PUT THIS COST-CUTTING COMBINATION TO WORK FOR YOU NOW!



BLAKE CHAMFER GRINDER (Described in Bulletin 531) BLAKE FLUTE GRINDER (Described in Bulletin 631)

ACCURATE, TRUE-CUTTING TAPS
LESS TAP BREAKAGE
600% MORE PRODUCTION PER TAP
UP TO 75% REDUCTION IN TAP COSTS

Write for details about both machines!

EDWARD BLAKE COMPANY 435 CHERRY ST., WEST NEWTON 65 MASSACHUSETTS

BLACK DIAMOND PRECISION DRILL GRINDERS...
WALTHAM CUTTER SHARPENERS...SURFACE FINISH STANDARDS

From the *American Machinist* Library of *Tips for Top Shop Men*

YOUR manufacturing engineers should have just one job: to make your present methods obsolete. The more they succeed, the greater is your productivity.

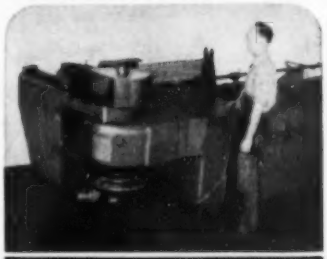
AN invisible boss presides over every collective bargaining session. He is not labor, management, or government—but is the customer, who exercises power of selection over your company's products.

TWO of management's most important words are "know" and "no." If you're strong on the first, you seldom hear the second.

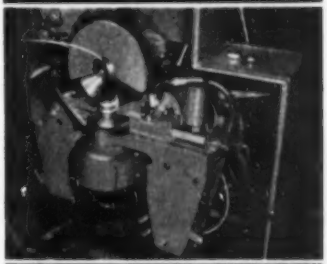
PRODUCTION Short-Cuts with PINES Hydraulic BENDING EQUIPMENT

Tooling Set-Ups Engineered To Meet Your Needs

Here are five examples of bending applications illustrating how Pines machines are successfully employed to save time and cut costs on a wide range of bending work. As shown, different tooling setups are engineered and easily applied to handle a variety of production requirements. Hydraulic power, which is used on all Pines Benders, assures accurate, uniform production results and safe, dependable performance. Push-button controls and automatic operation assure high efficiency and production economy. There's a complete range of Pines Benders designed to handle light or extra heavy work, small lot, or high production runs. Call on Pines engineers when you need help with a bending problem. There is no obligation. Phone Aurora 2-7608.

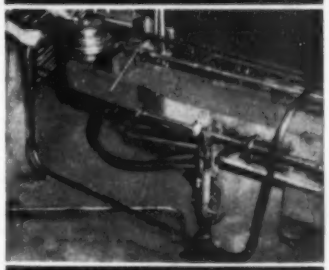


1. MULTIPLE GROOVE DIE — on Pines Size 3 Automatic Bending Machine forms ten 7/16" x .67-1/2" steel rods simultaneously to a 22" radius for farm implements.

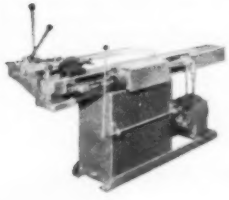


2. DOUBLE DIE AND CUT-OFF SETUP — on Pines Size 3/4 Automatic Bender. Produces 3/4" copper return bends to 7/8" c/l radii automatically, two pieces at a time.

4. FORMING BLOWER HOUSINGS ON PINES ROTARY BENDER — bends irregular curve (radii of 5-17/32" to 7-3/4") in 5-1/2" width stock at a speed of 89 pieces per hour. Floating bronze pad acts as a wiper shoe, maintains uniform pressure, assures smooth, wrinkle-free results.



3. TRIPLE RADIUS SETUP — on Pines Size 3/4 Automatic Bender handles three different radii and six 90-degree bends in 1-1/8" tubing in fast sequence. Increases truck seat frame output with less handling.



5. PINES SEMI-AUTOMATIC BENDER — tooled for production-line bending of extruded aluminum automotive moldings. Simple setups and easy manual toggle clamping also provides unusual economy for variable short-run and maintenance work not adaptable to fully automatic equipment. Hydraulic power assures uniform results, safe operation.

***Write* TODAY FOR FREE LITERATURE**

Write for free literature describing and illustrating various Pines Benders, attachments, and methods on actual jobs. Find out how Pines Benders are designed to save time and cut costs on a wide range of work.

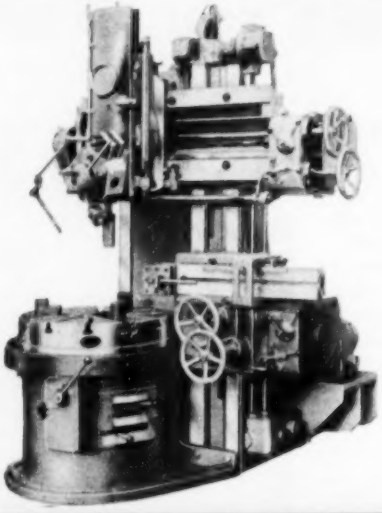
PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

BENDING • DEBURRING • CHAMFERING • THREADING MACHINERY

672 WALNUT • AURORA, ILLINOIS

New WEWAG VERTICAL TURRET LATHES



SINGLE COLUMN BORING & TURNING MILLS

Arranged for direct V-Belt motor drive, hardened and ground gears, 5-Face Turret and Side Head, power rapid traverse to both heads.

SIZE	**36"**
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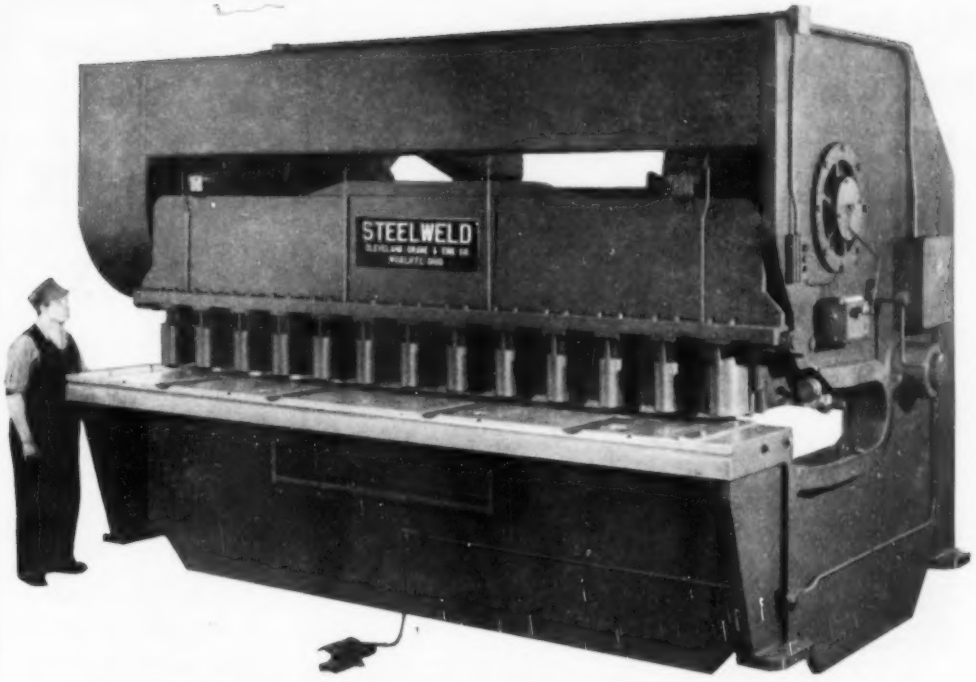

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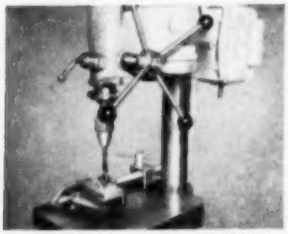

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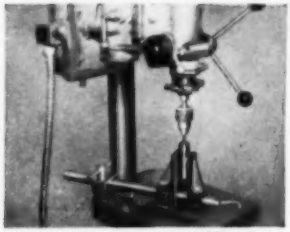

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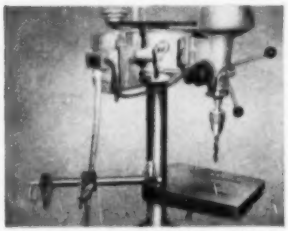

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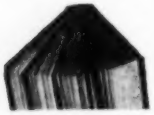

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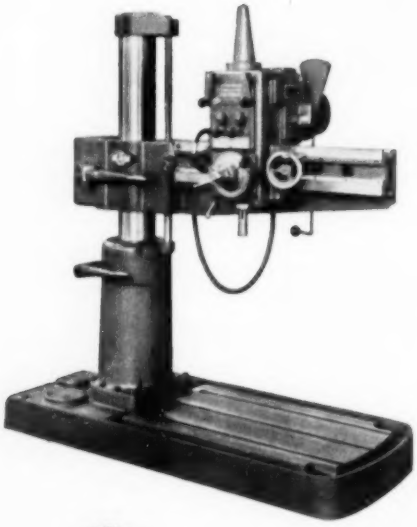

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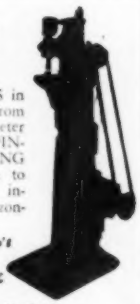

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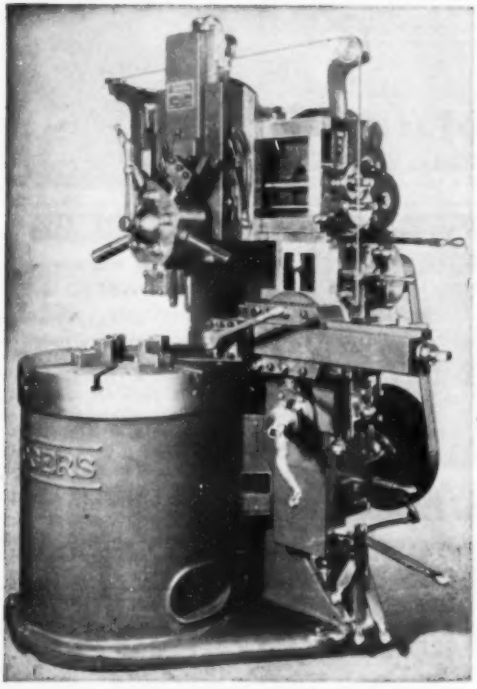

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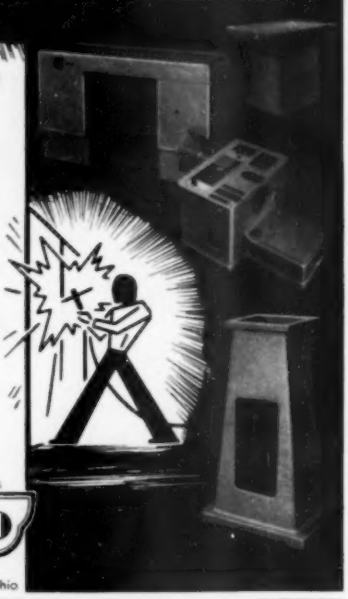

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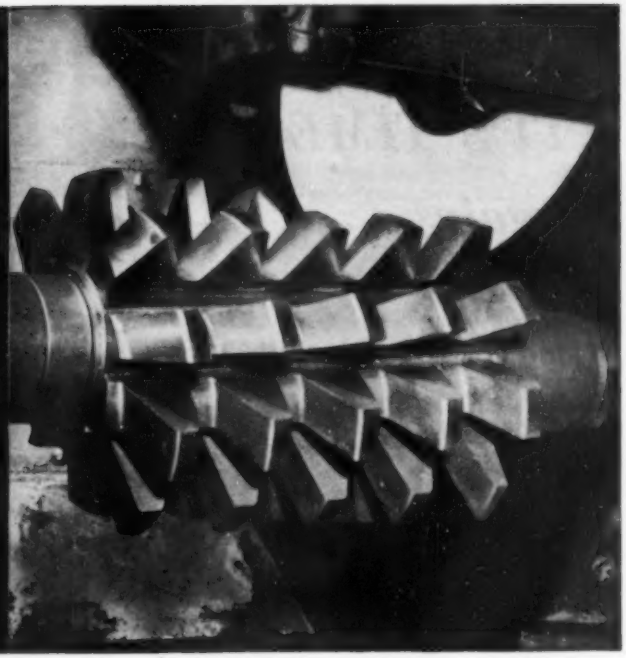

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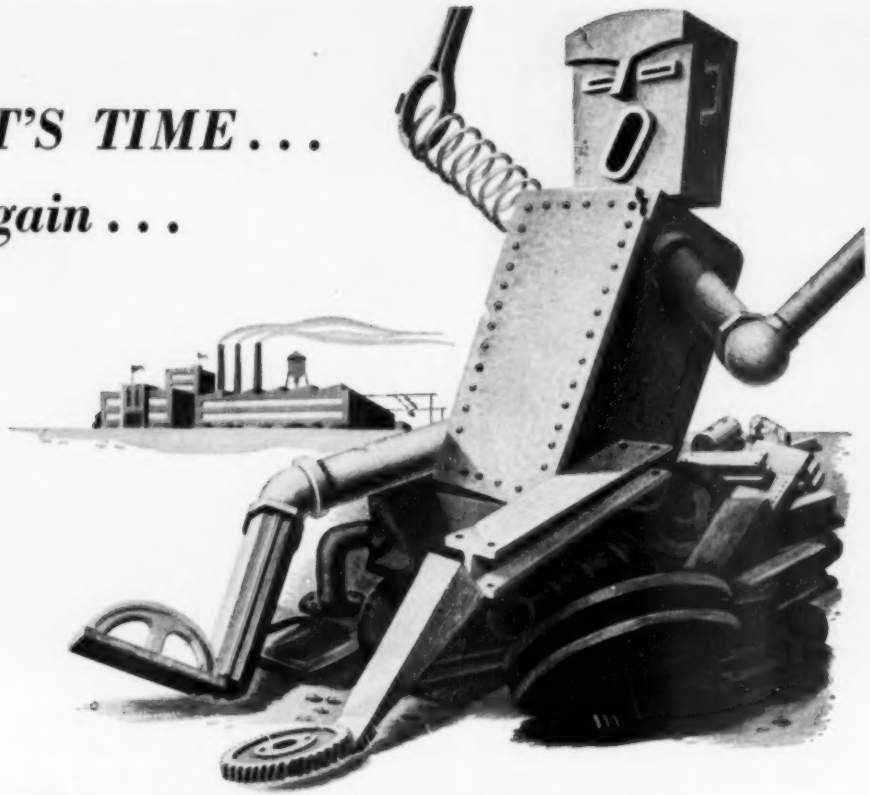

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20'x1" Pyramid Type Plate Bending Roll. Drop end type.

NATIONAL
4" High Duty Forging Machine; Back Stop and Overarm Heading and Gripping Slides, Direct Motor Drive.

NORTON
23"x72" High Swing Plain Cylindrical Grinder, 1943.

MacDELL
CORPORATION
1042 WEST LAKE ST.
CHICAGO 7, ILLINOIS
PHONE: MONROE 6-7715

2 Martin Hydraulic Marking Machine, M.D.
2 LODGE & SHIPLEY Duomatic Lathe
BAIRD Cut & Carry Drawing Press
2 HEALD Sizematic Internal Grinder
24"x6' c.c. LODGE & SHIPLEY Engine Lathe, Selective Head, M.D.
4" RICE BARTON SPLINE MILLER
20" HENDEY Heavy Duty Shapers (2)
MILWAUKEE 2-8 Universal Millers (2)
PERKINS Trimming Press with Side Shear
Numerous Other Machine Tools
CURRIER MACHINE SALES
1055 State Street, P. O. Box 1503
New Haven, Conn.

LATE TYPE
(2) 2 Buffalo Single Spindle Drill Presses 4 M. T. (1948)
(1) 2 Buffalo Two Spindle Drill Press 4 M. T. (1948)
(1) 2 AC Ohio Super Gear Finisher (1943)
(1) Model E Cleveland Tapper (1948)
(1) J & L PC14 Comparator (Ped. Type 1944)
(2) 2 K. O. Lee Tool & Cutter Grinders (1942)
(1) 2 Ransome Welding Positioners (1944) Table 38" x 38"
(6) 50; 60; 75 K. V. A. Spot Welders (1944)
(1) 6-42 Bliss S. S. Press. Bed 42x34
C. S. MacDONALD INC.
1238 Parker St. Springfield, Mass.
Telephones: 3-9569 & 7-4040

FOR SALE:
8—Potter and Johnson
AUTOMATIC CHUCKING MACHINES
2 6A—Model 2 with 16" chucks and 5 H.P. motors. Will swing 13" and will supplement your present turret lathes. Recently overhauled and in good condition. May be inspected under power. Will sell lot for $20,000.00, including tooling, spare parts, extra cams, gears etc., or will sell in pairs for a slightly higher figure.
COLUMBUS PRODUCTION MANUFACTURING COMPANY
935 W. Goodale Blvd.
Columbus 8, Ohio

MONTHLY BARGAINS
Cleveland 6 spdl. Automatics Model K. 1¼". Ser. No.'s 34758-34813. Lots of tooling. Threading and Tapping spindle.
Landis Type C Cyl. Grinder 8 x 18", Ser. No. 32413. Hyd. Table Traverse Reconditioned.
Barnes Hone Model 173, 6" depth 2" diam.
Warner & Swasey Turret Lathe No. 4, Ser. No. 325427, Motor in Base, Bar Feed and chucking.
FOSTER MACHINERY SALES CO.
18800 Hawthorne, Detroit 3, Mich.

HYDRAULIC PRESS
Small bed area, floor type. A-1 condition, just rebuilt.
FABRICATING MACHINERY SALES
2430 Central Parkway, Cincinnati 14, Ohio

SHEET METAL MACHINERY
NEW & USED COMPLETE LINE OF
Box Brakes, Press Brakes, Notchers, Shears, Punches, Rolls, Spot Welders, Q. Rite, Peate Welding Equipment, etc.
B. D. BROOKS, INC. 161 Atlantic Ave.

FOR
SOMETHING RARE
in a Heavy Turret Lathe
See our ad on page 226
Industrial Plants Corporation
90 West Broadway, New York 7, N. Y.
BArclay 7-4185

2 UNIVERSAL MILLING MACHINES
DELIVERY MAY, 1952
Brand new—no priority
Model 2-51—Spindle Taper #40—3 HP motor—Rapid Traverse with 1¼ HP motor—Table surface 44"x10"
Manufactured in France to U. S. standard—unusually fine construction.
HUDSON RANDALL INTERNATIONAL
131 E. 48 St., New York 17, N. Y.

FOR SALE
2 BROWN & SHARPE UNIVERSAL HORIZONTAL MILL.
3 x 36 Hartnes J & L. 24" upright drill.
CRAWLEY BOOK MACHINERY CO.
328 Keturah St., Newport, Ky.
Tel: Colonial 8228 (Cincinnati)

UNUSUAL BUYS WITH GUARANTEED PERFORMANCE

PARTIAL LIST OF LATHES

American 48"x30' bed, Internal Face Plate Drive, 10' centers, 2⅞" hole in spindle
American 36"x40' bed, Internal Face Plate Drive, 33' centers, 2⅞" hole in spindle
American 26"x14' bed G.H., 12 spindle speed, taper attachment
American 24" x 12' bed 3 SCD, motorized
LeBlond 20"x16', 3 SCD, 9' center distance
Bradford 20"x10' bed, 4 SCD, 12' centers
Reed Prentice 20"x10' bed, G.H., 79" centers, Timken bearing
Lodge & Shipley 20"x8' bed, single pulley
Bays & Emmes 18"x8', 3 SCD, motorized
American 18"x8', 4 SCD, 30" centers
Lodge & Shipley 18"x6', single pulley
LeBlond 17"x8' bed, 3 SCD
Monarch 16"x8' bed, 3 SCD, motorized
American 16"x8' bed, 3 SCD, bowl head
Lodge & Shipley 16"x6', single pulley
LeBlond 15"x8' G.H., 9 spindle speeds
Lodge & Shipley 14"x6', 3 SCD
American 14"x8', 3 SCD, bowl head

BORING MILLS—Vertical

Niles 80"-44", 1 rail and 1 side head.
Pond 10', 2 heads on rail
King 42", motorized, 2 heads on rail
Colburn 54", motorized, 2 heads

GEAR MACHINERY

Gould & Eberhardt 96N Gear Hobber
Gould & Eberhardt 60BM Gear Roughar
Gould & Eberhardt 50H Hobber
Gould & Eberhardt 18H Hobber
Fellows 612 Spur Gear Shaper
Fellows 725 Gear Shaper, with spur guide
Brown & Sharpe 4-48 Gear Cutter
Brown & Sharpe 1-28 Gear Cutter

GRINDERS—Cutter & Tool

Brown & Sharpe #10 Cutter & Tool, late
Sellers 4T Tool Grinder, late type
Sellers 6T Tool Grinder, late type

GRINDERS—Internal

Heald 78 Centerless, Internal & Cylindrical, late type
Micro, Model F.G.
Heald #70A, new 1941

GRINDERS—Cylindrical

Landis 10x18 Type C Plain, late type
Cincinnati 10x36 Plain Cylindrical, swings 35" in gap
Landis 16"x72" Plain Cylindrical

GRINDERS—Thread

Jones & Lamson 0x31, late type

MILLERS—Plain

Brown & Sharpe 2V, 4 SCD
Brown & Sharpe #3, 4 SCD
Kempsmith #3, 3 SCD
Brown & Sharpe 4B, single pulley drive

MILLERS—Universal

Kempsmith #1, 4 SCD, motorized.
LeBlond 2½ Heavy Duty, 3 SCD, motorized

PLANERS

Cincinnati 24x24x8' Double Housing
Liberty 30x30x18 Double Housing

SHAPERS

Smith & Mills 14" Plain Crank, Lima drive
Gould & Eberhardt 18" B.G., gear box
Barker 18" B.G., 4 step cone drive
Averbeck 21" B.G., 4 SCD
Cincinnati 24" B.G., 4 SCD
Gould & Eberhardt 24" B.G., gear box
Smith & Mills 25" B.G., 4 SCD
Columbia 28" B.G., gear box drive
Gould & Eberhardt 28" B.G., gear box
Gould & Eberhardt 32" B.G., gear box
Smith & Mills 32" B.G., gear box drive

MISCELLANEOUS MACHINERY

TUMBLING EQUIPMENT
ALMCO DB-7 Tumbling Machine, barrel 30x72"
ALMCO SU-1 Screening unit, motorized
ALMCO Hoist Pan & Hook
ALMCO Hopper
ALMCO Screen Door
This is brand new equipment

H&G Model 1-K Threading Machine, late
Taft Pierce Bench Center, 8"x48" centers
Hoffman Heavy Duty Portable Cleaner
Erie Steel Metal Shrinker
Model #22 Rodgers Hand Truck Press

BANNER MACHINERY

Cincinnati Machinery Co., Inc.
219 East Second Street
Cincinnati 2, Ohio

FINE LATE TYPE GUARANTEED TOOLS

60"x25' NILES BEMENT POND Geared Head Engine Lathe, rapid traverse

56"x18' C.M.C. Heavy Duty Lathe, 24 Speed Geared Head, power rapid traverse, 30 HP AC motor

14"x30" HENDEY Toolroom Lathe, 12 speed geared head, collets, chuck, taper attachment

No. 11 GISHOLT Turret Lathe, bar feed, chucks, new 1942

No. 2B FOSTER Geared Head Turret Lathe, rapid traverse, AC motors

No. 5 FOSTER Ram Type Universal Turret Lathe, bar feed, taper attachment, motor in base

No. 60 NEW BRITAIN Automatic, 1" capacity, 6 spindle, rebuilt, new 1942

42" BULLARD Vertical Turret Lathe

24" BULLARD New Era Type Vertical Turret Lathe, side head, motor drive, threading attachment

100" BERTRAM (Niles Patterns) Vertical Boring Mill, 2 heads on rail, rapid traverse, new 1932

No. 1 DOUGLAS Plain Horizontal Mill, table 8"x32", power feeds, motor in base, No. 40 taper, new 1942

No. 5 CINCINNATI Plain Horizontal Mill, rectangular overarm, MD

3 Spindle FOSDICK Drill, No. 2 Morse taper 12" overhang, 1 HP 3/60/220 motor on each spindle, new 1942

No. 3 AVEY Type MA6—4 spindle Drill, Avoymatic power feed, No. 3 Morse taper, new 1942

4' AMERICAN High Speed Sensitive Radial Drill, 9" column, AC motor on arm

No. 6 TOLEDO O.B.I. Press, 56 Tons

72A5 Heald Sizematic Internal Grinder

25A HEALD Rotary Surface Grinder, 24" diameter, magnetic chuck

36" OHIO Dreadnaught Shaper, AC—MD

36" ROCKFORD Hydraulic Openside Shaper Planer new 1940

36"x36"x10' G.A. GRAY Maxi-Service Planer, reversing motor drive, box table, rapid traverse

1½" LANDIS Bolt Threader, leadscrews, AC—MD

75 Ton HENRY & WRIGHT Double Crank Dieing Machine, roll feed & scrap cutter

255 ton STOLL Double Crank Press, 108" R to L x 33" F to B, 8" stroke, AC—MD

O'CONNELL MACHINERY CO.
Tel: BAldy 5800
1695 GENESEE ST. BUFFALO 11, N.Y.

MODERN MACHINES

#3 Brown & Sharpe Vertical Milling Machine
60" Hanchett Face Grinder
Bench Multiple Spindle Drill, Type W7
6D Putter & Johnson Automatic Checking Machine
#30 Waterbury Farrell Thread Rollers
#0 Brown & Sharpe Automatic Screw Machines with Turner Drives
#3 Barber Colman Hobbing Machine
G1-A Acme Gridley 1½ Automatic Screw Machine
10" Gould & Eberhardt Shaper
(2) #3 Cincinnati Millers-Ser. A1804 A and A1804 B
#3 Standard Plain Kearney & Trecker Miller—Ser. E11 1529

HAZARD BROWNELL MACHINE TOOLS, INC.
350 Waterman St., Providence, R. I.

NEW LATHES AT BARGAIN PRICES

New 18" x 80" Centers MEUSER LATHE and 24" x 120" Centers MEUSER LATHE. Complete with Taper Attachments, Chucks and all equipment. *GAP BED TYPE.* Available from stock all sizes up to 32" Swing. Will trade for other equipment.

WINSTON MACHINERY CO., INC.
326 W. OHIO ST. INDIANAPOLIS 2, IND.
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1⅞" Cone 8 Spindle Auto. Screw Machine Serial #1498XX with 25 HP 220/440 Motor. Price $9,500.

12" 6-Spindle Bullard Multi-Au-Matic Type "A" Serial #11642. Price $8,500.

12" 6-Spindle Bullard Multi-Au-Matic Type "A" Serial #14386. Price $9,500.

ECORSE SCREW MACHINE PRODUCTS CO.
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BUY FROM STOCK
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FALK
MACHINERY COMPANY

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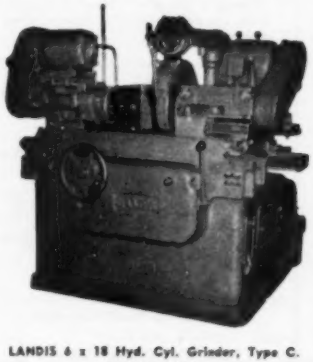
Every Item Guaranteed as Represented

AUTOMATIC, #00 Brown & Sharpe, 5/16" cap.
AUTOMATIC, Cleveland Model #B-1½" Spl. Spdl.
AUTOMATIC, B & S #20, 1" Cap. M.D.
AUTOMATIC, National-Acme Spln. Spdl. 4½".
BALANCER, Anderson Bros. 14"x54". Roto-Checker.
BORING MILL, 50" Betts Vert. 2 heads.
BORING MILL, 10" Cinc. Vert., M.D.
BORING MILL, Lucas #31 Horiz. 3" Bar.
BORING MILL, Giddings & L #32 Horiz. 2½" Bar.
BORING MILL, Ryerson #11, Horiz. 2½" Bar.
BORING MILL, 24" Bullard M.D., V.T.L.
BARRELS, Tumbling Locomatic, Baird.
BRAKE, Chicago #812 Hand Bending.
BROACH #3 LaPointe Horiz. 58" Str.
COMPRESSOR, Ingersoll Rand ER-1, 10 HP. M.D.
COMP., 15 HP. 10 HP. Gardner Denver, M.D.
CRANE, OET Shaw 15 tons, 58'7" span.
CRANE, Conton #8 Portable Gooseneck 3 ton cap.
CRANE, OET Ricker 2 tons 11'9" span.
CHIP WRINGER, Barrett #251, M.D.
CUTTER, 74" Oswego Automatic Paper, M.D.
RADIAL DRILL, 3'9" American, M.D.
RADIAL DRILL, 3'7" Mueller, M.D.
RADIAL DRILL, 4'x11" American, M.D.
RADIAL DRILL, 5'10" Cincinnati-Bickford.
RADIAL DRILL, 6'10" American, M.D.
RADIAL DRILL, 30" Walker Turner M.D., Late.
DRILL, Foolick 18", S.S. Power Feed, M.D.
DRILL, #2 Colburn M.D., #4 M.T., M.D.
DRILL, #121 Baker Auto. S.S. Cam Operated.
DRILL, Deep Hole, Avey-Draulic ??
DRILL, Deep Hole, Pratt Whitney #2 Gun Barrel.
DRILL, Edlund #2B, 3 spdle, #2 M.T., 10".
DRILL, Cincinnati 21" with Tapping Attach.
DRILL, Natco Multiple Spdle #12, #1 M.T.
DRILL PRESSES, Leland Gifford #1MS, 1, 2, 3, 4
DRILL PRESS, #2MS Buffalo Forge single spindle.
DRILL, Barnes, 24" S.S., #4 M.T., 19½" cap.
DRILL PRESS, #25 Fosto-Burt S.S. 26", #M.T.
DRILL, #2MS Leland Gifford, 4 spindle, #2 M.T.
DEEPFREEZE Motor Products 40° below zero.
DEMAGNETIZER, SB-911 Magnaflux, late type.
FILER, #11-S Cochrane Bly Auto Saw Filer.
FILER, Oliver Type P4, Floor Type, M.D.
FURNACE, Westinghouse Elec. 18 KW. 2100° F. cap.
FURNACE, Machine Steam Oven, Serial #2543.
GRINDER, Disc, Besly #205, 18" Dble. End.
GRINDER, Arter 18" Rotary Surface.
GRINDER, Cylindrical, Brown & Sharpe #2 Uni.
GRINDER, Oakley #3 Univ. Tool & Cutter.
GRINDER, Heald Rotary #25, M.D.
GRINDER, Hydraulic Contour Landis Cam 5"x40".
GRINDER, Cylindrical, Norton 10"x24", M.D.
GRINDER, Brown & Sharpe #4 Univ. 12"x60".
GRINDER, Cylindrical, Cinci, Gnld Filmatic.
GRINDER, Thread, Jones & Lamson #TG-815.
GRINDER, Landis Crankshaft 10x32 Hydraulic, M.D.
GRINDER, Brown & Sharpe #2 Auto. Horiz. Surface
GRINDER, Heald #72A-3 Internal Size-Matic.
GRINDER, Pratt & Whitney 14x36 Vert. Surface.
GRINDER, Pratt & Whitney 22"x84" Vert. Surface.

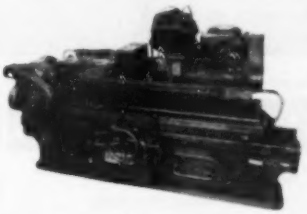


LANDIS 6 x 18 Hyd. Cyl. Grinder, Type C. Serial #29196.

GRINDER, Greenfield #12 Int. Hydromatic.
GRINDER, #51 Oliver Auto. M.D. Drillpointer.
GRINDER, #35 Abrasive Vert. Auto. Surface.
GRINDER, McDonough Univ. T & C Late.
GRINDER, #22 Heald Horiz. Rotary Surface.
GRINDER, Diamond Snagging 10 HP. 24"x4½".
GRINDER, Norton 0x18 Vert. Surface, Hyd. Late.
GRINDER, #1 Moore Jig M.D. Late.
GRINDER, #00 & #70 Heald Internal.
GRINDER, Landis 8"x18" Hyd. Cyl. late type.
GRINDER, Sellers Type #1A Tool, 24" wheel.
GRINDER, Porter-Cable #B-1, 10" Belt, M.D.
GEAR HOBBER, #3 Barber Colman, M.D.
GEAR HOBBER, B & S #34 Sour, 10" dia.
GEAR SHAPER, Fellows #6 High Speed.
GEAR SHAPER, Fellows #7 High Speed.
HAMMER, Rochester Hispeed, all sizes M.D.
HAMMER, Bradley 200# Rubber Cushioned Helve.
HEADER Manville #1 S.S.B.D. Cold, 9/16".
INDUCTION HEATER, 15 KVA, Ecco Hi Frequency.
AIR MOTOR HOIST, Ingersoll Rand 2000# cap.
ELECTRIC HOISTS, 500-4000 lbs. Whiting, NEW
KEYSEATER, #5 Mitts & Merrill, Giant, M.D.
KEYSEATER, #6 Mitts & Merrill Giant, M.D.
LAPPER, 2F Norton Vert., M.D., late type.

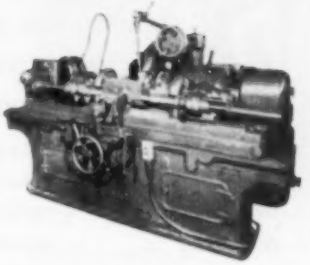
DISC GRINDER

Ostorheim 37" Wheel Diameter Disc Grinder. 40 HP. TEFC 3/60/440 spindle motor drive. 24" capacity.



LANDIS Type "D" 5" x 40" Motor Driven Hyd. Semi-Auto. Cam Contour Grinder. Equal to New.

LATHE, Le-Swing 8"x100", M.D., A.C.
LATHE, Porter-Cable 8"x15" Geared Head Prod.
LATHE, Hendey 12"x5", Q.C.G. Taper Attach.
LATHE, LeBlond 14"x6', Q.C.G.
LATHE, Hendey 14"x8' Q.C.G. Taper Attach.
LATHE, Lodge & Shipley 16"x5', Q.C.G., Grd. Hd.
LATHE, American 16"x5' Q.C.G., Grd. Hd.
LATHE, Lehman 16"x7' Q.C.G., M.D.
LATHE, Lodge & Shipley 18"x8', Q.C.G., Gr. Hd.
LATHE, American 18"x10' Q.C.G., Grd. Hd.
LATHE, South Bend 18-28"x8' Gap Bed, Q.C.G.
LATHE, Hendey 20"x10' Q.C.G., Taper Att.
LATHE, Reed-Prentice 20"x10' Grd. Hd.
LATHE, LeBlond 22"x10' Q.C.G., M.D.
LATHE, Putnam 24/32"x12' Q.C.G., M.D.
LATHE, LeBlond 24"x14' Q.C.G., Grd. Hd.
LATHE, Lodge & Shipley 26"x14', Q.C.G., M.D.
LATHE, McCabe 26/48"x18' Double Spindle Lathe.
LATHE, Bridgeford 27"x12' Geared Head, M.D.
LATHE, Bridgeford 32"x10' Q.C.G., Grd. Hd.
LATHE, Pond 36"x108" Grd. Hd. With Equip.
LATHE, Bullard Dble. End #VMTS, Devlieg Bros.
LATHE, Turret #1 Burdsal & Oliver Electric Head.
LATHE, Turret, #2 Simmons Vari Drive 220 V.
LATHE, Turret, #4 Warner & Swasey Univ. 1½".
LATHE, Turret, #6 Warner & Swasey Grd. Hd. Ram Type, Bar Feed, Motor in base.
LATHE, Turret #2 Cinci, Acme Univ. Geared Head.
LATHE, Turret, #3A Warner & Swasey Univ. M.D.
MILL, 36 H. Sundstrand Horiz. Hyd. 2 Spindle M.D., 50 Taper.
MILL, Nichols, Hand, Coolant, M.D. Late Type
MILL, #2 Pratt & Whitney Prod. Duplex, M.D.
MILL, 2A Brown & Sharpe Horiz. Univ., M.D.
MILL, #4B Brown & Sharpe H.D., Horiz. M.D.
MILL, #16 Garvin Plain Horiz., M.D.
MILL, #9Y Brown & Sharpe Plain Horiz., M.D.



LANDIS 10 x 32 Crankshaft Grinder.

MILL, Cinc. Horiz. #3, #4, #5, High Power.
MILL, #3 Cinc. Univ. Horiz., M.D.
MILL, #5C Becker Vert. Die Sinker, M.D.
MILL, #1 Brown & Sharpe Plain Horiz., M.D.
MILL, #0-8 Cinc. Vert. & Horiz. Prod. Late.
MULT-MILLER, U.S. Tool #MM-1-0, Auto. Prod.
MILL, #0 Verzas Hand Mill, M.D. Late
MILL, PLANER, Ingersoll 42x36x12, 4 heads.
MILLING MACHINE, LeBlond #4, Horiz. Univ.
MILLING MACHINE, Kempsmith #2 Horiz. Univ.
MILLING, Brown & Sharpe #2 Horiz. Univ.
MILLING MACHINE, Van Norman #2 Duplex.
MILLING MACHINE, K & T #2B Horiz., M.D.
NIBLER, Gray Turret Type ⅜"x24" cap.
NIBBLER, #2 Savage Roller Die ⅝"x30" cap.
OZALID Model "F" Whiteprint Machine, Late.
THREADING, Staysolt Lassiter Millholland 1½".
THREAD MILLER, Lees Bradner #40A Automatic.
THREAD MILLER, Plan-O-Mill #3 Planetary Form & Thread Semi-Automatic Milling Machine, Late.
PAPER SHREDDER, No. 10 Mitts & Merrill, M.D.
PLANER, Cincinnati 30"x30"x12' A.C., M.D.
PLANER, 48"x48"x12' Cleveland Openside.
POWER PRESS, Bliss #104 Open Back.
POWER PRESS, Bliss #3A S.S. Dble. Crank Grd. 45 tons, 4" stroke, 28"x24" Bed Area.
POWER PRESS—Bliss-Consolidated #153-B Straight Side Dble. Crank, 45 tons.
PRESS, #78½ Bliss S.S. 9½" Str., M.D.
PRESS, Robinson #5 O.B.I. 23 tons, M.D.
PRESS, Federal #2 O.B.I. Grd. 2" Stro.
PRESS, Bliss #18, #19, #20, #21, OBI, A.C., M.D.
PRESS Toledo 58½ S.S. 440 ton cap. 8" str.
PRESS, Waterbury-Farrell High Speed 60 tons #5W.
PRESS, 60C Bliss Double Action, 3 crank.
WHEEL PRESS, Chambersburg 400 tons cap. Hyd.
PRESS, Lucas 15 tons Power Arbor M.D.
PRESS, #6B Whitney Deep Thr. 24", foot.
PRESS, P2, P3 Forncouts M.D. Roll feed.
PANTOGRAPH, #1A Gorton M.D. Engraving.
PUNCH, Hecker Turret, 8 station, cap. 2½" hole.
PUNCH, H & J #2 Sgle. End, 24" Thr. 1" thru 1".
PUNCH H & J #5 Sgle end, 40" Thr. 2" thru 1½".
RIVET SETTER, ⅝" cap. Pneu. Tubular Rivet.
ROLLS, #1 Buffalo Forge Vertical Bending, NEW.
ROLLS, #1 Buffalo Forge Wrapping.
RBUTER, #W1460, Oberud, Electric H.D.
COLD SAW, Espen-Lucas #700, 48" dia. blade.
CUT-OFF SAW, Yates-American #M-90.
SAW, #302 Campbell Abrasive Cut-off.
SAW, #26-C Racine Shear Cut 8"x8" cap.
SAW, #5610 Abrasive Cut-off, New
SAW, Bond, Tannewitz &GH-30" High Speed.
SHAPER, 16" Pratt & Whitney Crank, M.D.
SHAPER, 32" Cinci, S.G., Motor driven.
SHAPER, Columbia 32" S.G. Crank.
SHAPER, Norton 36" Draw-Cut, 4-Speed.
SHAPER, G & K 24", high duty, book geared, M.D.
SHEAR, Quickwork #-1 Rotary 60" Throat, 18 ga.
SHEAR, #8E Niagara M.D. 8'x3/16" cap.
SLOTTER, 12" New Haven Vertical, M.D.
SPRUE CUTTER, Milwaukee 50 tons, 2½" cap.
SURFACE PLATES & TABLES, all sizes.
TAPPER, #1 CAM Haskins, Motor Driven, Late.
TAPPER, #1 Bakewell (Warner & Swasey) Late.
WELDER, 300 KVA Federal, Projection.
WELDER, 75 KVA Federal, M.D., Spot.
WIRE STITCHER, Morrison and Acme, M.D.

OTHER 2000 MACHINE TOOLS AVAILABLE "IN STOCK"

HARVEY GOLDMAN PRESENTS

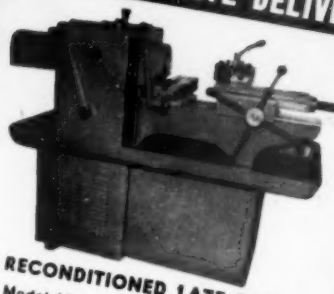
This Trade Mark Stands For:

- THE FINEST MACHINE TOOLS
- 3 GENERATIONS OF EXPERIENCE
- GUARANTEED SATISFACTION

CONSULT US WHEN YOU WANT THE BEST!

- AUTOMATICS
- BROACHES
- DRILLS
- GRINDERS
- LATHES
- MILLS
- PLANERS
- PRESSES
- SHAPERS
- MISCELLANEOUS

FOR IMMEDIATE DELIVERY



RECONDITIONED LATE TYPE
Model 601 W.D. Oster Turret Lathes
(Several)
For Bar and Chucking Work

A high speed, simplified machine capable of handling a wide variety of turret lathe work as efficiently as many more complicated and higher priced machines, and with less skilled operators.

HARVEY GOLDMAN & CO.

3900 SCHAEFER HIGHWAY • DEARBORN, MICHIGAN
TELEPHONE TIFFANY 6-4450

THE FOCAL POINT FOR PRODUCTION MACHINERY

LATE MODEL MACHINE TOOLS . .

AUTOMATICS
1⅝" RA-4 Acme Gridley Automatic. Late
9 1/8" RA-6 Acme Gridley Automatic. 1942
1¼" Cleveland, Model A. 1943
2-47A Heald Boromatic.

DRILLS
No. 82A Natco Single Spdl. Latest
10 Spindle Barnes, Hydraulic. 1942

DRILLS, RADIAL
4' Hammond, New
5' 11" Archdale. 1947

DRILLS SENSITIVE
No. 2 Allen Single Spindle. 1942
No. 2B-8 Edlund. 1942

GEAR EQUIPMENT
No. 6 Gleason Revacycle Generator. 1940
No. 66SA1 Fellows Gear Shaper. 1943
No. 615A Fellows Gear Shaper. 1942
No. 72 Fellows Gear Shaper. 1942
No. 7L6 Fellows Gear Lapper. 1942
Pratt & Whitney Gear Grinder. 1942
8" Red Ring Gear Shaver. 1941
15" Red Ring External Lapper. 1942
Red Ring Universal Gear Checker. 1942

GRINDERS, CYLINDRICAL
14"x180" Norton Plain Type C. 1942
14"x60" Landis Type C. Pl. Wyd. 1943
10"x18" Landis Type C. Pl. Wyd. 1942

GRINDERS, INTERNAL
No. 24-36 Bryant Hydraulic. 1943
No. 16 CP 18 Bryant Hydraulic. 1942
No. 16-16 Bryant Hydraulic. 1942
No. 172 Heald Hyd. Cap. 1940
No. 30 Heald Plain Hydraulic. 1941

GRINDERS, SURFACE
No. 22 Heald Rotary, 12" Chuck. 1945

GRINDERS, THREAD
No. 31 Excello Thread Grinder. 1941

GUN BARREL MACHINES
No. ½Bx50 P & W Reamer. Latest
No ½Bx50 P & W Rifler. Latest
No. ½Bx30 P & W Reamer. Latest

LATHES, PRODUCTION
No. 3FU Foster Fastermatic Platen. 1942
No. 12 Sundstrand Stub Lathe. 1942
10"x12" LaBlond Multi-Cut. Late
Lipe Carbo-Matic. 1942
Lipe Mechanical Carbo. 1942

LATHES, TURRET
No. 5 0 Acme Universal. 1943
No. 3R Gisholt Universal. 1943
No. 4R Libby Universal. 1942
No. 2G Moroy Power to Turret. 1942
H-5 Libby Universal. 1940
No. 5 Gisholt Universal. 1942
No. 2 Warner & Swasey Simplified. 1941

MILLS, PRODUCTION
No. 2548 Cincinnati Vert. Hydrotel. 1938
08 Cincinnati Vertical. 1943
No. 3A Sundstrand Copy Mill. 1942
Hall Planetary Form Mill. 1942

MISCELLANEOUS
2000 HP Midwest Dynamometer. 1942
75 H PGardner-Denver Air Compressor. 1942

PRESSES
650 Ton Verson Double Action Eccentric Press. 1940

SHAPERS
24" American Universal. 1942
20" Smith & Mills, Heavy Duty. 1942

Partial listing — Write for latest stock list

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MUST MOVE PROMPTLY FROM LOCAL CUSTOMER'S PLANT

BEMENT MILES 18" SLOTTER with 3" dia. spindle. M.D.

GOULD & EBERHARD 36" Gear Cutter M.D.

BROWN & SHARPE #5—48" Gear Cutter, M.D.

BINSEE MACHINERY COMPANY HORIZONTAL BORING MILL. Table 30"x64". Quantity of boring bars.

CINCINNATI 60"x48"x14' Planer. 4 heads. 1 extra side head on massive floor stand for open side work. M.D.

B & O #2 Turret Lathe 1" Cap. M.D.

FOOTE-BURT #25—24" Heavy duty Vert. Drill #5 M.T. Motorized.

GRINDERS—CYLINDRICAL. B & S #11. 7"x 32". Plain Grinder. Table swivels. Motorized with 4 motors.

LANDIS 10"x36" Plain, M.D. Also Planer type Grinder 16"x36".

"BEMENT" 36" STROKE TRAVERSING HEAD SHAPER. 48" travel to ram. 2 tables. (PLANER SHAPER)

WE HAVE A LARGE STOCK FROM WHICH TO SELECT. TELL US WHAT YOU WANT.

THE OSBORNE & SEXTON MACHINERY CO.
P. O. Box 88 Columbus 16, Ohio

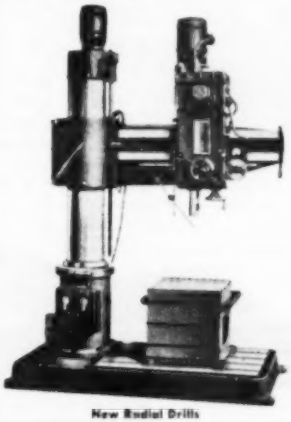
SOME LATE MACHINES STILL AVAILABLE

BORING MILLS

Cleveland 2½" Bar Cap.
Giddings & Lewis No. 0, 3" cap.
Giddings & Lewis No. 32, 3⅛" cap.
King 42", 72" Vert. 2 rail heads
Niles-Bement-Pond 4½" Bar
Niles-Bement-Pond 60" Vert.

DRILLS AND RADIALS

Bausch Multi-spindle
American 6'x15" Univ.
Buffalo #2 Motor Spindle
Cincinnati Bickford 6'x13" col.
Walker-Turner Radial. 2½'
Natco #12 20 spindle drill, Bausch
24" Sibley Sliding Head
Foote-Burt #25 1" cap.



New Radial Drills

ENGRAVERS

Deckel type 3 Dim., New
Gorton #1A, ME, Deckel G1L
Gorton #3B 3 Dimensional

GEAR EQUIPMENT

Barber-Colman #2, #12 (3)
Fellows High Speed Shapers 712, 725, 71
Flather 72" Cutter
Gleason 3" Straight Bevel Generator
Gleason #4 Angular Bevel Tester
Gleason #2 Surface Hardener
Gould & Eberhardt 36" Cutter
National Broach Rod Ring Lapper, Shaver
Schuchardt & Shutte #1 Hobber
Fellows #20M Rodliner

GRINDERS, MISCELLANEOUS

Bryant #5 Internal, chucking
Cincinnati 6x18" Cyl. Hyd.
Heald #73 Internal Centerless, Sizematic
Heald #81 Internal Gagematic
Heald 72A3 Int. Centerless Sizematic
Landis 6"x30" Type C Cyl.
Majestic Internal

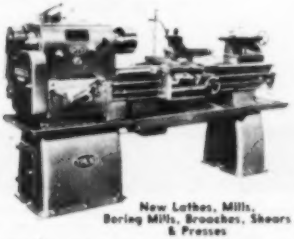
Norton Type C 6"x18" Semi-Automatic cyl.
Norton 6"x30", 10"x18" Type C cyl.
Norton 14"x96" cyl., 16x48 Univ.
Norton Roll Grinder 50"x28'
Oliver #510 Drill Pointer
Pratt & Whitney Radius #R6, K.O. Lee Tool
Sellers 6T Tool
Van Norman #666 Crankshaft
Wicaco Internal

GRINDERS, SURFACE

Abrasive 8x24", #33 Vert. & #34
#10 Blanchard 16" Chuck
Blanchard #16, 26" Mag. Chuck
Heald 22—12" chuck, Arter 12"
Norton 6x18" Hyd., Coolant
Pratt & Whitney 12x36" Vert.
Reid 11x36 Motor in Base

LATHES

American 14"x30
Bridgeford 36"x20', 32"x16'
Lodge & Shipley #3 Duomatics
Hardinge Precision 9", 1" Collet Cap., Rivett
Hendey 12"x42" and 12x30", 1941
Hendey 14" Yoke Head Lathes
LeBlond Regal 10"x3' bed
Lipe-Carbo 12"x18" (2)
Putnam 42"x17', Sebastian 12"x4' G.H.
Wickes 32"x35' Geared Head
Reid Small Pisco #9WSL
Sundstrand 8x15", 15" Stub
New 16, 18, 20", Immediate Del.



New Lathes, Mills, Boring Mills, Broaches, Shears & Presses

MILLS, PLAIN, UNIV. PROD.

Archdale Plain, 14", Prod.
Brown & Sharpe #3B Plain, Late, 3A, 21
Brown & Sharpe 2L Univ. New
Cinn. 08 Plain, #2 Univ. Dial Type, New
Cinn. No. 3, 4 Plain Spd.
Hardinge Model BB4, Kent Owens 1V
Milwaukee #2B, Plain & Univ.
Simmons Micro-Mill #1A
Sundstrand #00, 0, Rigidmills
Sundstrand #3A Rigidmill with Copying Attach

MILLS, VERTICAL

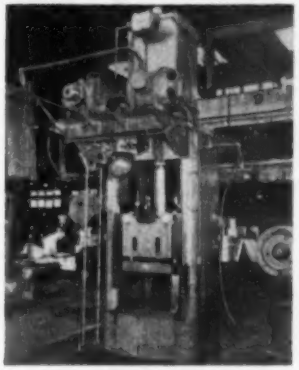
Brown & Sharpe #3 single pulley drive
Cincinnati #3, #4 hi-power
Cincinnati 08 Vertical
Morey #12M Profiler, 2 sp.
Pratt & Whitney Profiler 12D, 2 sp.

PRESSES

Bliss 645, 650 Hi-Production Presses
Bliss 18, 21, 215, OBI, 58, 62, 162, OB.
Bliss 4½ Double Action, Roll Feeds, Cam (2)
Bliss #78½, 330 Ton, 55, Bliss 74½
Hamilton 850 Ton S.S. Bed 27x48
Bliss 5-48 Dbl. 32x48" bed, Cushion
Toledo 92½ Dbl. Crank 43x23" bed.
Niagara Herring, 15 Ton
Niagara A1¾, O.B.I.
Toledo 29 Double Action Cam
V. & O. #102 O.B.I. Reducing
Walsh No. 3 O.B.I. 23 Ton

TURRET LATHES

Acme 6W Fox 2-9/16" Cap. #2 Cross slide
Brown & Sharpe, #2 Hand, #10, 11
Denver, 6 2" Shell Turret (2)
Foster #2B 2½" Cap.
Gisholt 1L, #5
Morey #2G Late
Oster 601 WD. #2 Simmons Microspeed
Warner & Swasey #1A, Timken Head
Warner & Swasey #1, 2, 3, 5 Late



150 Ton H.P.M. Triple Action Press 50 ton cushion, 50 ton blankholder, bed 36" x 36".

MISCELLANEOUS

Automatic, Cleveland Model B 1-1/16"
Automatic B & S #00G, 0G
Automatic 4 Sp. 1½ Conomatic
Band Saw: DoAll Zephyr 36", #8 Marvel
Hacksaw: Peerless 6"x6"
Hacksaw: #6A Marvel 6x6 cap
Honer: Micromatic H-4
Keyseater: Davis, Baker, M & M
Oster-Williams #915 Pipe & Nipple Threader
55 Bolt & Pipe & Threader
Shapers: 24" Rockford, 24", 28" Gould & Eberhardt. Cinn. 20, 24"
Shears Power: George Ohl 10' 3/16", 10' x 16 gauge, 11' 16 gauge
Welder: 50 KVA Enler Air Operated, Hew Seam.
Welder: Taylor-Winfield 50 KVA Hi-Wave

HYDRAULIC EQUIPMENT

SELF CONTAINED PRESSES

1500 Ton Briquetting or Ponder Metal Press, horiz. clamp cyl. 1000 tons.
125 Ton Southwark Press, Bed 96"x30". 30" stroke, 2 to 4 ft. opening
600 Ton William & White Up-moving Ram 42"x60" pluten 12" str., 24" opening self-contained

MISCELLANEOUS PRESSES

300 Ton Watson Stillman 24x20" Platen 11" St. 21" opening

All Hydraulic Equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your Hydraulic problems.

NEW IN STOCK

Air Hydraulic Presses — Arbor Presses #6C Famco — Band Saws Kalamazoo — Famco 6x12"—Drill Presses all sizes—Hydraulic Press Northern 20 Ton — Injection Molders, 1 ounce — Power Presses, OBI, 1, 4, 4½, 5, 7½, 10, 15, 20, 30, 55, 85 ton—Shaper 7" Amco, 8" Shaperite — Shaper Sheldon 12" — Shears, Foot 22" to 8', 16 & 18 ga.—Shears, Power 3'x18 gauge to 10' x 10 ga.—Welders, Arc, Seam, Spot all sizes Motors, Grinders, Buffers, all sizes.

This is but a partial listing. Write for free Catalog. Inquiries invited. HUNDREDS OF OTHERS

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Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY—THE MARK OF DEPENDABILITY

UPRIGHT DRILLS

24" Cincinnati-Bickford Super-Service, m.d.
20" Barnes All Geared, m.d., tapper
24" Aurora, belted m.d.
25" Weigel, belt drive, tapper
26" Aurora, m.d., tapper
26" Barnes All Geared Self-Oiling, m.d.
32" Aurora, belt drive
D6 Colburn, m.d., H.D.
No. 315 Baker Heavy Duty, t.p.d.

GEAR SHAPERS

No. 12 Fellows Gear Shaving Machine, m.d., late
No. 6 Fellows, belt drive
No. 7, 7A Fellows, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 81 Fellows, belted m.d.
No. 61A Fellows, m.d., latest type
No. 661 Fellows, m.d.
No. 615A Fellows, m.d., late type
No. 64A Fellows, m.d., latest
No. 645 Fellows, belt
No. 645A3 Fellows, m.d., late type
No. 72 Fellows, m.d., latest
No. 75 Fellows, m.d.

GEAR GRINDERS

6x20", Fitchburg Hydraulic Spline & Gear Grinder, m.d.
9" Pratt & Whitney Hydraulic Spur, m.d.
10" Pratt & Whitney Hydraulic Spur & Helical
No. 2MS Lees-Bradner Spur & Helical, m.d.
No. 13LS Fellows Gear Lapper, m.d.
50 11 Gear Grinding Machine, m.d., latest

GEAR HOBBING MACHINES

No. 12 Barber-Colman, single overarm, m.d.
No. 12 Barber-Colman, double overarm, m.d.
No. 34 Brown & Sharpe, m.d.
No. 66 Brown & Sharpe, m.d., Spur & Spiral

GEAR CUTTERS

No. 20 Cross Universal Gear Chamfering Machine, m.d.
Gleason Spiral Bevel Gear Rougher, m.d.
3" Gleason Straight Bevel, m.d.
8" Gleason Straight Bevel, m.d.
11" Gleason Straight Bevel, m.d.
Cincinnati Gear Burnisher, m.d.
Cross Gear Tooth Rounder, m.d., 9" cap.
National Broach & Machine Co. Red Ring Gear Speeder, 10" cap.

GEAR TESTERS

No. 1 Brown & Sharpe Spur Gear Tester.
12" cap. National Broach & Machine Co.
10" National Broach & Machine Co.

AUTOMOTIVE GRINDERS

Kwik-Way Model H Piston Turning & Grinding Machine, m.d., late
No. 76 Van Norman Automatic Piston Turning & Grinding Machine, m.d., late

CENTERLESS GRINDERS

No. 2 Cincinnati, m.d.
Cincinnati Valve Seat Grinder, cap. ⅝" valve stems, m.d.

PLAIN CYLINDRICAL GRINDERS

6x18" Landis Plain Self-Contained, m.d.
6x18" Landis Type C Hydraulic, m.d., late
6x30" Cincinnati Hydraulic, m.d.
No. 10 Brown & Sharpe Self-Contained, m.d.
No. 11 Brown & Sharpe Self-Contained, m.d.
10x24" Landis Plain Self-Contained, m.d.
10x36" Cincinnati Hydraulic, m.d.
10x48" Brown & Sharpe, belt
10x72" Landis, m.d.
10x72" Norton, motorized
12x36" Landis, m.d.
12x48" Modern, belted m.d.
12x96" Landis Plain Self-Contained, m.d.
14x18" Cincinnati Plain Self-Contained, m.d.
14x48" Cincinnati Plain Self-Contained, m.d.
14x52" Norton, motorized
20x120" Landis Self-Contained, m.d.
No. 20—10x18" Brown & Sharpe, m.d., late

DISC GRINDERS

No. 2 Gardner, belted m.d.
No. 151 Besly, m.d.
Hammond Disc Grinder, Model No. 600
Model V10 Hammond Belt Sander m.d.
No. 4 Gardner Disc Grinder, m.d.
No. 20 Gardner Comb. Disc Grinder & Roll Sander, m.d.
7½ H.P. U.S. Elec. Tool Co. Disc Grinder, m.d., new
No. 24—63" Gardner, m.d.

EMERY GRINDERS

5 HP. Baldor Pedestal Type, 3ZM
5 H.P. U.S. Electrical Tool Co. Model 95
#516 Mummert & Dixon Radial Emery Grinder, m.d., 5 H.P. motor
Hammond Model 6 Carbide Grinder

WRITE FOR COMPLETE STOCK LIST

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No. 00 B & S Automatics (12)
No. 0 B & S High Speed Automatics (3)
No. 0 B & S Automatics (8)
No. 0G B & S High Speed Automatics (3)
No. 0G B & S Automatics
No. 2 & 2G B & S Automatics
No. 19 B & S Automatics (4)
9/16" DA2 Davenport Automatic
4½" Cleveland "A" Automatic
1¾" Cleveland "A" Automatic, late (2)
1 1/16" Cleveland "A" Automatic, late
1" Greenlee 4 Spindle Automatic
8½"x8" Gess & deLeeuw Chucker
No. 454 New Britain 4 Spindle Chucker

TURRET LATHES

24" Bullard New Era Vertical
No. 4A W & S Universal, serial No. 309,000
No. 3A W & S Universal
No. 2G Morey, late (3)
No. 2 Simmons, Bar, late
No. 4 W & S GH and GFH Universals

MISCELLANEOUS

No. 3 Norton Universal T & C Grinder
8" Jones Vertical Shaper, late
6"x18" Norton Type C Grinder, late
No. 1A Milwaukee Mill
24" Cincinnati Duplex 6 Simplex
No. 1½ B & S Universal
No. 3VG Reed Prentice Vertical
12"x30" Hendey GH Lathe, late
25"x15" Ryerson-Conradson GH Lathe
12"x34" American GH Lathe #36295
3" Gleason Bevel Gear Generator, late
No. 3 & No. 12 Barber Colman Gear Hobbers (7)
Reynolds Automatic Screw Driver
16" Buffalo Motor Spindle Drill, late
6' Cincinnati Bickford Radial Drill
No. 354 Niagara Power Slip Roll, late
No. 2 Cincinnati Centerless Grinders (2)
No. 1½ Abrasive Surface Grinder, late
50 Ton Henry & Wright Dieing Press

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LAKE MACHINERY COMPANY
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McDONALD

USED MACHINERY

Norton 6x18" Horiz. Hand Surf. Grinder 1941
Cincinnati No. 2 Hi-Power S.P.D. Vert. Miller.
G & L and Lucas 3" Bar Horiz. Boring Mills.
20" All Grd. Camel Back Drill 1-Sp. and 4-Sp. Barnes.
Amer. 3' & Morris 3½' Arm Radial Drills.
Blanchard M.D. Vert. Sp. Surf. Grinder 20" chuck.
Campbell No. 213 abrasive cut off 1947.
Sundstrand 4-Sp. Vert. Rigidmill.
Heald #22 Rot. Surf. Grinder 12" chuck 1947.
Dual All Steel Press Brakes 6' & 10' 14-Ga. 1947.
Hilles & Jones 12' Pyramid Roll ¼" cap.
Baker No. 1 Vert. Keyseater 1½" cap.
Sheffield Model 101 Thread Grinder 1945.
Nazel #3-B Vert. Air Hammer A.C. M.D.
Landis 2-Sp. 2" Cap. Bolt Threader M.D.
Hendey 16"x8' bed Q.C.G. Lathe 1939.
W & S No. 4 Ram Type Grd. Hd. Turret Lathe
G & E 24" Gear Box Shaper Tilt. Table Top.
Newton 48" Table 1-Sp. Cont. Vert. Miller.
Rock River 100 Ton cap. Horiz. Bulldozer.
Foster 2-F Fastermatic Hyd. Turret Lathe.
Kempsmith No. 2 Vertical Maximiller M.D.
Heald #70-A Red Head Sp. Internal Grinder.
Springfield Planer Type Surf. Grinder.
Cochrane-Bly Tool Room Vert. Comb. Miller-Shaper.
P & J #2-M Auto. Prod. Miller, 2 Tables.
Foote-Burt #25 Box. Col. 1-Sp. Hvy. Drill.
L & N, 6', 10' & 12' Press Brakes.
Bullard 24" & 30" Vert. Turret Lathes.
Lynd-Farquhar 26" stroke openside Shaper Planer.

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Toledo 6" x 6" Saw, M.D.
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Unusual opportunity to procure modern Fellows Gear Shapers 615A and 645 as well as 12" Gleason Generators, 36 BM Gould & Eberhardt Roughers, #7 Fellows Gear Shaper, #16 D. E. Whiton Machine. Write for full information.

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HORIZONTAL BROACH
Single End American Horizontal Broach
12 Ton, 130" Stroke. New in 1943.

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AUTOMATIC SCREW MACHINES
BILLINGS & SPENCER #B2 DI-MATIC, auto. bar cap. 2⅝" M.D. Late.
GYROMATIC Model 40 15/8" 6 spindle, Late.

BORING MILLS—Horizontal
FRANKLIN 4½" Bar; table type; M.D.
LANDIS #40, 4" Bar; floor type; M.D.
LANDIS #35 floor type; 3½" bar; M.D.
LUCAS #41; 3" Bar; table type; P.R.T.
NILES 6" bar floor type, motor drive
UNIVERSAL; 3" Bar; table type; precision. Late.

BORING MILLS—Vertical
BETTS 120" 2 heads P.R.T.; M.D.
BULLARD 8", 16" 6-spindle. "A" Mult-au-matic
COLBURN 72", 2 heads PRT. M.D.
NILES 48"; motor drive (heavy)

BROACHES
CINCINNATI 1-30 Duplex Vert. Hydr.
COLONIAL V.G. 1-10-48; Vert. Hydr. late.

DRILLS—Radial
CARLTON 3'9" Plain, M.D. Late.
CINCINNATI BICKFORD 6'15" Univ.; M.D.
KITCHEN & WADE; 2½' 10"; M.D.

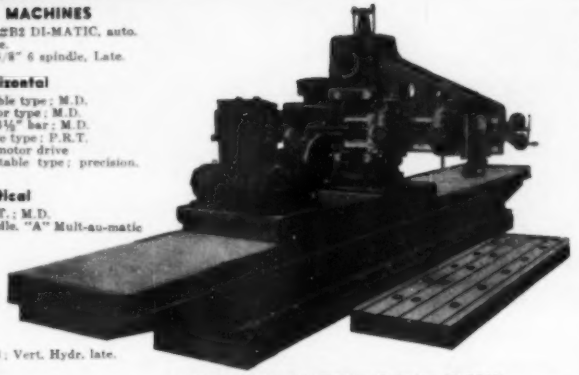
DRILLS—Miscellaneous
BARNES No. 420 Deep Hole; late
BARNES H-3 Hydram; hydr.; inverted; late
BARNES H-2 Hydram; hydr.; M.D.
BARNES 20" 4-spindle Camel Back; Late
BARNES 24" all geared; Camel Back; M.D.
BODINE #42-20 multi-univ., dial feed; M.D.
MOLINE 6-spindle Hole-Hog 3⅝"; M.D.
NATCO No. 14 Mult.; Rect. Hd.; PRT; M.D.

GEAR CUTTING EQUIPMENT
BILGRAM 6" & 16" Bevel Gear Cutter, M.D.
BROWN & SHARPE 6-72" Auto. Cutter; M.D.
CROSS #1, #40, #45 Tooth Rounders; M.D.
FELLOWS No. 4 Enveloping Gear Gen., M.D.
FELLOWS Nos. 6tA, 6tE, 7tS, 7t, 7tA, 7S, 7E, 7I High Speed Gear Shapers; late
FELLOWS 18-LS Lapper; late
GLEASON 25" straight double gear generator; M.D.
GLEASON #13 Special bevel cutter-grinder; M.D.
GLEASON 18" bevel gear Tester & Lapper; M.D.
GLEASON #6 Revacycle. Late type.
GLEASON 5" & 12" Straight Bevel Gen.; late
GLEASON #4 & #6 Tester, Late Type
GLEASON 10", 11" & 18" Bevel Gear gen.
GLEASON 24", 37", 77", 96" Bev. Gear Planer
GLEASON No. 14 Hypoid Grinder; late
PRATT & WHITNEY 10" Gear Grinder; late
SYKES #8A gear generator; M.D.

GEAR HOBBERS
BARBER COLMAN #12 Motor Drive
GOULD & EBERHARDT #36 H; Late
GOULD & EBERHARDT #36BM 3 spindle Auto. Rougher; M.D.
KOEFFER WM-11 Auto.; bench type; Late
PFAUTER RS1: Max. dia. 30"; late

GRINDERS—Plain Cyl. & Univ.
CINCINNATI 6x18 cyl. Pl. Md.
CINCINNATI 14x72 Model EM Plain, Late
CINCINNATI Mod. EA 6x18 Pl. Cyl. Hydr.; M.D.
HEALD 72-A-3, 72-A-5 Plain; motor drive
LANDIS 10x36, 16x36 C Pl., Hyd., Late
LANDIS 6x18" Type C Plain; Hydr.; late
LANDIS 30" x 240" Plain cyl., M.D.

GRINDERS—Surface
ARTER 8" Rotary, M.D.
BILLITTER & KLUNZ 48"x196" Way Grinder
HEALD #22 Rotary, 12" chuck; m.d. Late
PRATT & WHITNEY 14x36" Model B, Late
TAFT PIERCE 6" Rotary, M.D.



BILLITTER & KLUNZ Way-Grinder 48x196"

GRINDERS—Misc.
BRYANT No. 5, 5, 16-C-16, 16-CP-16, 24 Intl. Hydr.; Late
EXCELLO #48 Carbide Late
GLEASON No. 12 Tool Sharpener; late
HEALD 350 Internal Hydr. Late.
HEALD #72A3 Plain Internal. Late.
HEALD No. 72-A-5 "Gagematic" Int.; Late
HEALD No. 72-A-3 "Gagematic" Int.; Late
HEALD No. 78 Internal Centerless; M.D.
LEMPCO 22x72" Mod. KG Crankshaft; Late
NORTON 10x72; type C; plain; M.D.
NORTON 10x120; plain; M.D.
VAN NORMAN 666 Crankshaft Regrind
VAN NORMAN 639 Osc. type Radius; Late

LATHES—Engine & Mfg.
AMERICAN 36"x360" centers; 2 carriages
AMERICAN 36"x33" centers geared heavy
DENHAM 16x48", 12x64", 16x72" (gap), M.D.
JONES & LAMSON "FAY" 20x25" Auto, Late
LEHMANN 25x96" center; Timken; grd. M.D.
LeBLOND 16x36" center; Auto.; Timken; late
LeBLOND Mod. 7ACL Crankshaft; M.D.
LODGE & SHIPLEY 24"x96" centers; Late
LODGE & SHIPLEY No. 5—24" and 96" centers DUOMATIC; Timken; Late
LoSWING 4x60", 8x24", 8x108"; late
MONARCH 18"x72" centers, Model "BDD" Hardened ways, geared head, Late
NILES 30"x46", 30"x50' Boring; "Time-Saver"; Timken; Late
SPRINGFIELD 14"x43", geared; M.D.
SUNDSTRAND 10x60" Auto. Late Type
SWIFT 16"x72" Centers, M.D. Late.

LATHES—TURRET
MOREY No. 2 ram type TIMKEN
GISHOLT 1L, Saddle type, M.D.
MAGDENBERG Model MWF-BG-250 Univ. table type; P.R.T.; 12" hole through spindle; cross sliding turret; M.D.; Late

MILLING MACHINES—Pl. & Univ.
BROWN & SHARPE No. 12 Plain; M.D.; late
BROWN & SHARPE #2 Standard Timken; M.D.
CINCINNATI #2 & #4 H.P. Timken; M.D.
KEMPSMITH #2 Timken; M.D.
CINCINNATI 0-8 Simplex; M.D.; late
CINCINNATI 4-48, 4 spindle, Tracer; Late
ROCKFORD Rigid-Mill #3 M.D.
CINCINNATI No. 3; dial type; H.S.; Univ. late

MILLING MACHINES—Mfg.
GOULD & EBERHARDT 25 Cont. type; M.D.
INGERSOLL 32x24x16' Planer Type; 2 hds.
INGERSOLL 30x24x12' Adj. Rail Slab; M.D.
ROWBOTTOM Cam Miller
SUNDSTRAND Mod. 3A Duplex 42" feed M.D.
TAYLOR & FENN M-80 Duplex Spline; Late

MILLING MACHINES—Thread
HALL Style D Planetary, Late Type
LEES BRADNER HT 12", 54", M.D.; Late
LEES BRADNER HT 12x36" M.D.; Late
MOREY 12x30" centers; late
PRATT & WHITNEY 4½x12 Mod. C; late

PLANERS
BETTS CONSOLIDATED 84"x92"x16' 4 heads PRT Box Table; DC Reversing M.D.
BETTS CONSOLIDATED 108"x84"x 44' 4 heads; PRT; Box Table; M.D.
CLEVELAND 48"x48"x12' Openside; AC; M.D.
GRAY 36"x36"x16', 4 heads PRT. Late.
NILES 108"x84"x42' 4 heads; Rapid Traverse; Box Table DC; M.D.
NILES-BEMENT-POND 72"x72"x30' 4 hds.; Rapid Traverse; M.D.
NILES-BEMENT-POND 60"x60"x12' Rapid Traverse, 3 swivel heads, box table, M.D.

SAWS
CAMPBELL #401 Abrasive cut-off, Late.
ESPEN LUCAS No. 670 30" cap Hydr.; Late
HELLER Model SS-1, 6⅝ Cap Cold Saw

SHAPERS—SLOTTERS
DILL 18" Slotter; motor drive
PRATT & WHITNEY 6" Vertical; M.D.
PRATT & WHITNEY Mod. M 1251 10" Vertical
LYND FARQUHAR 26" Openside; M.D.
NEWTON 15" Slotter; M.D.
ROCKFORD 20" vertical, Hydr.; Late

PRESSES
BESCO Mod. 21 Incl. 40 ton, 3" stroke NEW
BIRDSBORO 325 ton Vert. Hydr; Late
BLISS No. 410A Toggle Drawing; tie rod; steel gearing
BLISS No. 3½A geared toggle; dble. acting
GLEASON 15" Quenching; hydr.; M.D.
HANNIFIN, 6-ton, 16-ton; hydr. Late.
NATIONAL #5 H.S. Maxi-Prone (Forging)
WATERBURY Farrel 125 Ton; St. Side

MISCELLANEOUS
ACME 2" Upsetter; Mod. XN; Motor Drive
AJAX 3½" forging, upsetting; M.D.
BAKER #5 Keyseater; motor drive
BARNES No. 172, 314 Honing; hydr.; Late
CHAMBERSBURG 600 H.P. Billet Shear
CROSS #45 Tooth Gear Chamfering Machine
DeLAVAL No. 194 Coolant Clarifier; Late
FISCHER No. 1, Oil Groover; Late
GROB GB-20 Metal Band Saw—2 unit; M.D.
LANDIS 2" Dble. Spdle. Threaders; M.D.
LeBLOND #2 Barrel Lapper; M.D.; Late
MANVILLE 2C Auto Screw Slotter; M.D.
MANVILLE No. 2 Slotters; Late
MANVILLE No. 3 Trimmers; Late
MANVILLE No. 2 DSOD Reedher; M.D.
MANVILLE 1A DSSD Heater; M.D.
MANVILLE No. 3 Reheaders; Late
MANVILLE No. 3C Thread Roller; M.D.
NIAGARA #116 Squaring Shear, Late.
QUICKWORK #6, ⅝" cap. #6, 1" cap.
REED Thread Roller, Late
SAUNDERS 8-18" Pipe Machine; M.D.
ULTRA LAP #10 Lapper, M.D. Late.
US TOOL 610-B Cutter Reliever; Late
WATERBURY FARREL No. 11 Thread Roller

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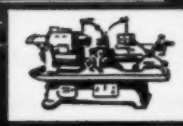

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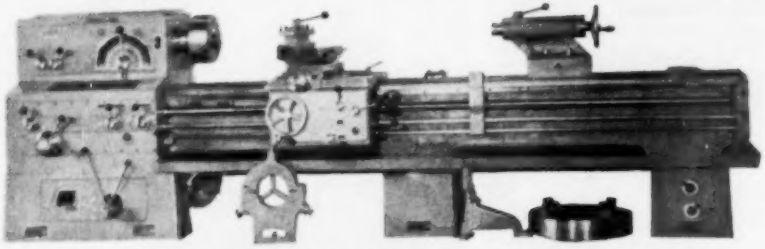
NEW LARGE HEAVY DUTY MEUSER LATHES



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24" x 100" Centers New Meuser Lathe, Gap Type, 34" Swing in Gap, 27 Spindle Speeds, (7.8-900 RPM). Complete with the following equipment: Three and Four Jaw Chucks, Follow Rest, Steady Rest, Four Way Tool Post, Centers, Standard Tool Post, Threading Dial, Carriage Stops.

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HEAVY TURRET LATHE

Equivalent to 4A - New 1943

Arranged for chucking—used 1 year. Will take 8" thru spindle, cross sliding turret. Swings 33" over bed, 20" over crosslide. 24 speeds 12-260 RPM; power rapid traverse. Taper attachment for crosslide, copying attachment for turret.

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J. & L., 2¼" x 24", Serial 40,215. Priced right.

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1½" CLEVELAND Automatic Screw Machine
#2N TURRET TYPE SOUTH BEND LATHE
#2 ROBOT SURFACE GRINDER, A.C. MOTOR
9"x6' SOUTH BEND G.C. LATHE, TAPER ATTACH.
12" x 30" NORTON UNIV. CYLINDRICAL GRINDER

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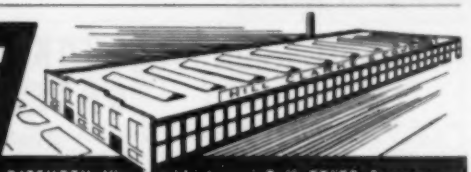

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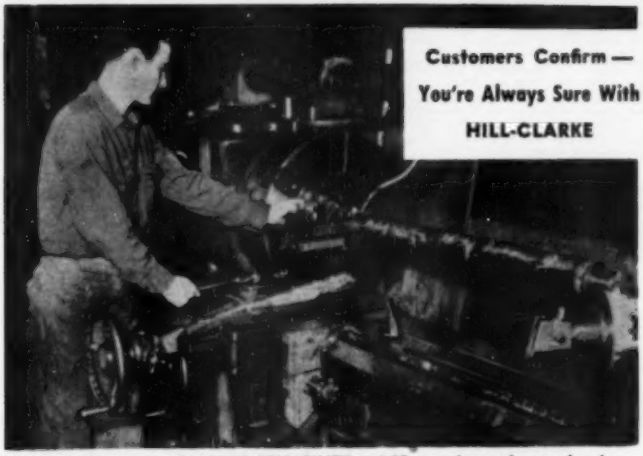


"WE DEPEND on HILL-CLARKE'S RELIABILITY and 85 years' experience when buying used machine tools" says THE BRIDGEWATER MACHINE CO., a jobbing shop in Akron, Ohio. Purchased from Hill-Clarke is this 4A Warner & Swasey Universal Turret Lathe used for cutting of center tube of aircraft Pylon Adapter.

AUTOMATICS

⅞" G Model Gridley
1-1/16" Model A Cleveland (1942)
1½" Foote Burt (1941)

DRILLS

1 Spdl—15" Sw—No. 2 Avey, Cam Fd.
1 Spdl—24" Sw—No. 2 MA6 Avey.
2 Spdl—24" Sw—No. 2 Aveymatic
4 Spdl—24" Sw—No. 3 MA6 Avey.
6 Spdl—14" Sw—No. 2 LMS L.G. Hyd.
21" Sw Defiance—No. 4 Taper
D-31 Fox Multiple Drill, No. 2 Taper.

GEAR MACHINES

No. 12-H Gould & Eberhardt Hobber
No. 12HS Gould & Eberhardt Hobber.
11" Gleason Bevel Gear Generator
No. 6 Gleason Bevel Gear Tester ('42)
No. 64 Fellows Gear Shaper
No. 36-BM G & E 3 Spdl. Rougher
No. 65 Fellows—Cone Dr.

BORING MACHINES

Rockford—3⅛" Bar
72" Niles—Hvy. Pattern

GRINDERS

6"x18" Norton Cylindrical (1943)
10"x36" Norton Cylindrical (1943).
Hill-Clarke Norton Type Motor Driven Grinders
10"x36" centers
10"x50" centers
10"x72" centers
10"x96" centers
14"x36" centers
14"x72" centers
16"x120" centers
16"-40" gap x 120" centers
18"x96" centers
18"-30" Gap x 96" centers
20"x96" centers
24"-32" Gap x 144" centers
No. A-3—12" Arter Rotary Surf.
No. 25-A Heald Surface Grinder
5A Bryant Internal
5B Bryant Internal
No. 72-A-5 Heald Internal (1942)
No. 16-16 Bryant Internal Grd.
No. 16-28 Bryant Internal Grd.
No. 24-26 Bryant Internal Grd.
No. 81 Heald Centerless Internal
No. 81 Heald Int. Cen.-Sizematic
No. 74 Heald Internal Centerless
No. 44 Excello Carbide Tool Gdr.

LATHES

14"x6' Walcott Lathe
15"x8' LeBlond Hvy. Duty Lathe
20"x9' Chard Lathe
36"x18' Putnam Grd. Hd., M.D.
No. 4 Warner & Swasey Tur.-Bar Fd.
5W Acme Ram type Tur., 2" Capacity
No. 6 Warner & Swasey Tur.-Bar Fd.
18" Libby Tur. Lathe, M.D.
No. 1 Acme 20½" Swing, Saddle Type

MILLING MACHINES

No. 08 Cincinnati Vert.
No. 3 Sundstrand Rigidmil
6"x168" Pratt & Whitney Thrd. Mill
10"x48" Hanson-Whitney (1942)

MISCELLANEOUS

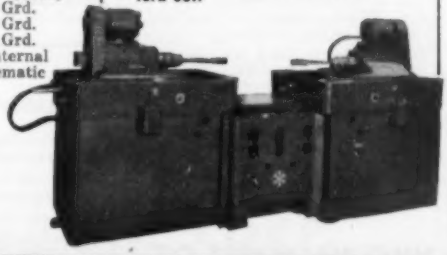
24" Milwaukee Shaper
15" Dill Slotter
18" Dill Slotter
38" Morton Draw-Cut Shaper (1945)
No. 0 Bakewell Tapper
No. 200 Micro. Horiz. Hone, 1 Spdl.
No. H-2 Micro. Horiz. Hone, 2 Spdl.
Model 200—H5 Micro.—Horiz.—2 Spdl.
14' Niles-Bement-Pond Roll
No. 6 R & K Straight-side Press, M.D.
42"-16 Ga. Economy Shear, M.D.
4-B Marvel Hack Saw
No. 5 Reynolds Power Screw Driver
75 Ton Hannifin Hyd. 4 post press
No. 175 G. T. Schmidt Marking Mach.
200 Ton Verson Hyd. Press

PLANERS

36"x36"x12' Cincinnati, 2 hds.
36"x36"x12' Gray, 2 Hds.
42"x42"x10' Cincinnati 2 hds.
48"x36"x14' Gray, 2 hds.
48"x48"x12' Cincinnati; 2 hds.
48"x48"x12' Gray Maxi-Service
48"x60"x27' American, 4 hds.

Attention!

Model 200 H-5 Double End Micromatic Hone. See this machine in our plant, tested under power. Know what dependable work it can turn out.



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UNUSUAL TOOLS

GEAR HOBBER

No. 72H Gould & Eberhardt universal. Now in 1942 and used very little.

PRESS BRAKE

10'6"x⅜" Cincinnati type. New 1941.

BROACH

12 ton, 32" stroke No. VU 12 Lapointe vertical hydraulic pull up, new 1948.

BROACH GRINDER

No. RG36-51 Colonial round broach grinder, serial No. M 11299, new in 1948.

DRILL

One No. 7½-A-14 Baker two way hydraulic horizontal with 7½ HP motors. New 1946

DRILL & TAPPER

Natco two way horizontal hydraulic, indexing fixture, total horsepower 17, new 1947.

GRINDER, INTERNAL

One 72A3 Heald plain hydraulic, cross-sliding head, 1943.

Three No. 24-36 Bryant, new 1941

One No. 16-28 Bryant, new 1943.

GRINDER, DISC

30", No. 84A Gardner double end opposed disc with hoppa and disc feed, 25 HP spindle motors, new 1938.

GRINDER, SURFACE

12", No. 22 Heald rotary, serial No. 9874, new 1940.

GRINDER, THREAD

No. 33 Excello, new 1943. Now arranged for groove grinding.

HONING MACHINES

No. 172 Barnes, new 1942.

No. 2610 Barnes, new 1940.

MILLER, THREAD

8"x16" Hanson Whitney, new 1941.

No. CT36 Lees Bradner, new 1941.

MILLER, SPLINE

Two 4", Model M-80 Taylor & Fenn, new 1939 & 1942.

PRESS HYDRAULIC

500 ton Baldwin Southward, 42x52 bed, 20" stroke, 36" daylight. New 1939.

1000 ton Baldwin Southwark, 42x54 bed, 20" stroke, 36" daylight. New 1940.

PRESS, DRAWING

650 ton No. 8411 Hamilton double action double crank toggle. Hydraulic clutch. New 1938.

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AUTOMATIC SCREW & CHUCKING MACHINES

(2) NATIONAL ACME Model R-6 Automatic—6 spdls.—1" cap.—considerable tooling—MD—
(3) GRIDLEY 1¼" Automatics—4 spdls. — stock reels and stands — feed tubes and fingers — misc. equipment—MD—
GRIDLEY 2½" Automatic—4 spdls.—stock reels and stands—feed tubes and fingers—misc. equipment—MD—
CONE 4¼" Automatic—4 spdls.—arranged for bar work—misc. equipment—1944 machine—MD—
POTTER & JOHNSTON #6 DRE Chucker—swing 36"—timken bearings—5-Face turret—MD—
NEW BRITAIN #3B Chucker—1⅝" cap.—single spindle—work rotating—MD—

PRESSES

NATIONAL #2 Massivess—500 Ton cap.—stroke 6"—bed 20" x 34"—MD—
BLISS #1006 Straight Side—135 Ton cap.—stroke 1½"—bed 20" x 28"—MD—
BLISS #31B Open Back Power—45 Ton cap.—stroke 4"—bed 32½" x 22½"—4-in rod frame—
V & O #12 Double Action OBI—plunger stroke 2½"—outer slide stroke 1¼"—MD—very late type—

GRINDERS

CINCINNATI Model EA 6" x 30" Plain Hydraulic—Sinuatic bearings—4 Motor drive—1946 machine—
BROWN & SHARPE #70 Plain—10" x 18" cap.—electrically controlled—MD—late type—
HEALD #72A3 Plain Internal—Heald Rod Head—3-Motor drive—
HEALD #72A5 Plain Internal—Heald Rod Head—3-Motor drive—late type—
THOMPSON Model "A" 6" x 12" x 18" Hydraulic Surface—chuck—generator set—late type—
HEALD #25A Rotary Surface—30" chuck—max. swing 54"—MD—late type—
HANCHETT 10" x 30" Series DK Face—cup-wheel—1946 machine—

MISCELLANEOUS

LINDE-OXWELD Type CM-12 Cutting Machine with line tracer and circle cutting attachment—very late—
INTERNATIONAL 4-Stage Dip System Washing Machine—MD—continuous—very late—
VERSON Model T-15-18, 300 Ton All Steel Press Brake, 10' x ½" cap.—MD—late type—
HILLES & JONES 18' x ½" cap. Bending Roll—pyramid type—MD—
HILLES & JONES #6 Guillotine Bar Shear—cap. 5" round—blades 10"—MD—

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HORIZONTAL BORING MILL

1—Barrett floor type, 20 H.P., 220 V. DC motor drive—400-1600 RPM 6" Boring bar with 3¼" extension bar 36" from bar to table. Table 19'0" long. Cutters and heads to bore 8" to 36". Can be seen in operating condition.

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OSWEGO, N. Y.

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'Rice's' Guaranteed Tools

9—#2 Cincinnati Centerless Grinders; Timken Bearings; M.D.

23"x72" Norton Type "C" Hi-Swing Cylindrical Grinder (1943)

25A Heald Rotary Surface Grinder, 24" Chuck (1941)

#4 Warner & Swasey Bar Feed Turret Lathe, Serial #220,000

16"x78" American High Duty Lathe, Rapid Traverse, Step Feed, (1938)

10" Nat'l Acme Automatic Chucker, 4 Spdl, 11" Elec. Chucks (1938)

Hilles & Jones #2 Leveling Roll, 10"x86" Rolls, M.D.

Pels #MK10 Universal Ironworker, Like New, Mtr. Driven

#1LMS Lel. Giff. 2 Spdle. Bench Drill to 9000 RPM (1941)

#2 Buffalo Mtr. Spdle. Drill, Pow. Fd., 600 to 3600 RPM (1942)

#61 Fellows 36" Gear Shapers (2) Ext. & Internal.

#12 Barber Colman Gear Hobber, Dble. Overarm, Finest

Pratt & Whitney 10" 2 Wheel Hyd. Gear Tooth Grinder (1943)

#3A Warner & Swasey Turret Lathe, 4½" Bar Feed

24"x24"x6' Liberty Planer, D.C. Rev. M.D., Box Table

28" Rockford Openside Shaper Planer

Robert W. Rice and Company

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Radial Drills—4' x 12" Round Column #4 Morse Taper, 2 motors, coolant, table. 1 in stock, others May.

Engine Lathes—12" x 40" centers, standard equipment, with gap 18" Swing complete. 2 April 15th, others May.

Engine Lathes—16" x 60" centers, taper attach., 3 jaw, 4 jaw, dial, with gap, complete. 2 in stock, others May.

Engine Lathes—20" x 80" centers, taper attach, 3 jaw, 4 jaw, dial, with gap, complete. 1 April 15th, others May.

Photos & Details upon request.

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1941-1952 MACHINE TOOLS

IMMEDIATE DELIVERY — NO PRIORITIES NEEDED

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VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

CUTTER & TOOL GRINDERS

FELLOWS: Flat Top Helical Gear Cutter Grinder
OLIVER: #2 Face Mill Cutter Grinder
OLIVER: 10" Template Tool Bit
RANSOM: 2-Wheel Grinder 3 HP
RUSSELL: 40" Saw Sharpener (New), automatic indexing

DRILLING MACHINES

ALLEN: #2 High Speed, 15" overhang
ARCHDALE: Radials (New)
PRATT & WHITNEY: ½B x 50 Deep Hole Reaming Machine

GEAR CUTTING MACHINES

BROWN & SHARPE: No. 6 Gear Cutter, 72" diameter, 1¾ D. P. capacity
CLEVELAND: Model 140 Rigidhobber, 1943 (like new)
CLEVELAND: Model 130 Rigidhobber, 1943 (like new)
FELLOWS: #4 Enveloping Gear Cutter
FELLOWS: 61A Shaper, 18" dia.
FELLOWS: 64A Shaper, 18" dia.
FELLOWS: 72 Shaper, 7" dia.
FELLOWS: Flat Top Helical Gear Cutter Grinder
FELLOWS: Straight Line Generator, 3" dia. with many cutters
GLEASON: #12 Rough & Finish Gen.
GLEASON: 3" Straight Bevel Gear
SYKES: Gear Shaper 14" external, 20" internal (New)
SYKES: Rack Cutting Machine 12" to 36" length capacity (New)

GEAR AND SPLINE GRINDERS

PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
GEAR GRIND MACH: GG-19, 10"x 24" Hydr. Spur Gears and Splines
GLEASON: #18 Spiral, Zerol & Hypoid, capacity 24" P.D.

GEAR FINISHERS & TESTERS

FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical
FELLOWS: #12C Cone & Spacing Inspection Instrument
GLEASON: No. 4 and No. 6 Bevel Gear Testers, Hand and Power
NATIONAL BROACH: SIC-12" Red Ring Gear Testing Machine

GRINDERS—CYLINDRICAL

BROWN & SHARPE: No. 10 capacity 6"x18" plain
CINCINNATI, 6"x18" Hydraulic, plain
LANDIS: 16x32" Type "D" Crankpin, hydraulic, for grinding crankshafts

Grinders—Cylindrical—*Cont.*

LANDIS: 6x18" External
LIDKOPING: Centerless (New)
NORTON: 10"x36" plain, hydraulic
NORTON: 10"x18" 45° angle wheel

GRINDERS—GEAR & SPLINE

GEAR GRIND MACH.: GG-19, 10"x 24" Hydr. Spur Gears and Splines
GLEASON: #18 Spiral, Zerol & Hypoid, capacity 24" P.D.
PRATT & WHITNEY: 10" single and double wheel, hydraulic feed

GRINDERS—INTERNAL

BRYANT: No. 5Y Internal
BRYANT: 16C16 Hole, Hydraulic
HEALD: 72A3 Sizematic Centerless

GRINDERS—RADIUS

VAN NORMAN: #73, capacity 7½"
VAN NORMAN: #639, capacity 7"
VAN NORMAN: #649, capacity 6" to 16" diameter
VAN NORMAN: #3½ Un. Radius

GRINDERS—SURFACE

ARTER: A-1—8" Rotary
HEALD: 8" Rotary
HEALD: No. 22 Rotary—12" Chuck

GRINDERS—THREAD

EXCELLO: #31 External, dia. 5"x18"

HONING MACHINES

BARNES: No. 306H Vertical, 24"
MICROMATIC: H-510 Double End Horizontal, ¾" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2-spindle, ¼" to 1" dia.

LAPPING MACHINES

FELLOWS: 8LSI and 13 LSI Gear Lappers, external and internal spur and helical
NORTON: No. 26 Hyprolaps, for flat work & cylindrical lapping
NORTON: 2Fx40" dia., for flat work

LATHES—PRODUCTION

DIMCO: Geared Head 12" to 66" swing (New)
AMES: 1" Bench, with attachments (New)
BLOUNT: Polishing speed lathe 12" dia. x 48" centers
LODGE & SHIPLEY: #3A Duomatic, 25¼" swing x 27" centers
PROGRESS: Geared head 16" to 30" swing (New)
ERNAULT: Toolroom lathes, 11 to 20" swing (New)
ERNAULT: High production hydraulic duplicating and copying lathes (New)

LATHES—TURRET

HERBERT: Turret Lathes, all sizes (New)
WEBSTER & BENNETT: Vertical Turret Lathes 36" & 48" (New)
MOREY: #2G

MILLING MACHINES

CINCINNATI: 2-spindle Vertical Hydrotel with two rotary tables of 36" dia.
DIMCO: #2 and 3 Univ. (New)
DIMCO: #3 Vertical (New)
RICE-BARTON: Duplex Spline
SUNDSTRAND: No. 0 Rigidmil
TAYLOR-FENN: M-80 Duplex Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

PRESSES

HPM: 1500 ton Hydraulic Briquetting Press, 24x48 platen (1943)
GEN. FLEX: Screw Press, 3 ton

SAWS & CUT-OFF MACHINES

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LANDIS: 2½" single head horiz. threading machine
LEES-BRADNER: 40A Thread Miller
MURCHEY: #22 Horizontal threading and tapping machine, ½" to 2½" dia. capacity, single spindle
NATCO: Vertical Tapper 16 spindle

MISCELLANEOUS

CUT-OFF: Campbell, abrasive 425 Cutalator 4½" dia. Capacity
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CUT-OFF: Pipe & Tube, 10" Williams
PRESS: HPM 1500 ton Briquetting
PRESS: Screw. Gen. Flex. 3 ton
RIVETER: Gen. Engr. 24" throat
TEST STAND: Denison 918-AM Hyd.
LATHES: Blount Polishing Speed Lathe, 12" dia. x 48" centers
PUNCH SHAPER: Sentinel Shrewbury, Thiel type design (New)
SHAPERS: Klopp 16 to 26½" (New)
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SHAPERS: Dimco 16 to 33" (New)
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75/100	Whse.	600/1200	SA-13L SB
50	G.E.	600/1200	LC
50	Reliance	400/1000	T-985F TEFC BB
50	Reliance	300/1200	T-985T BB
50	Cr. Wh.	300/1200	CMC SB
40/50	Whse.	500/1500	SK-131 SP BB
40/50	Reliance	500/1500	T-461T BB
40/50	Whse.	400/1600	SK-131 BB
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25	G.E.	350/1400	RF-162 SS
20/30	Imperial	400/1600	D-D69 BB
20/40	Reliance	300/1200	T-651 TE BB
20	Reliance	400/1600	T-461F TEFC BB
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GRINDER, 20"x120" Landis Cyl. Hyd. AC
GRINDER, 10"x46 Bryant Int., 1943
GRINDER, Micro Internal, large capty.
GRINDER, SURFACE 14"x30" P & W
GRINDER, SURFACE, 10" Blanchard No. 16, M.D.
GRINDER, No. 6T Sellers Tool 1942
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ES NATCO Multi. Spindle Drills—Hyd. table, 1942
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#12 FELLOWS Gear Shaper, '43
#725A FELLOWS High Speed Gear Shaper, '42
#36BM GOULD & EBER, Gear Rougher, 1941
36" MORTON Draw Cut Shapers (2), '43

MISCELLANEOUS

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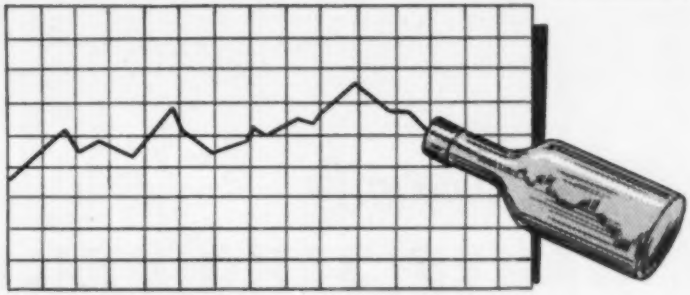

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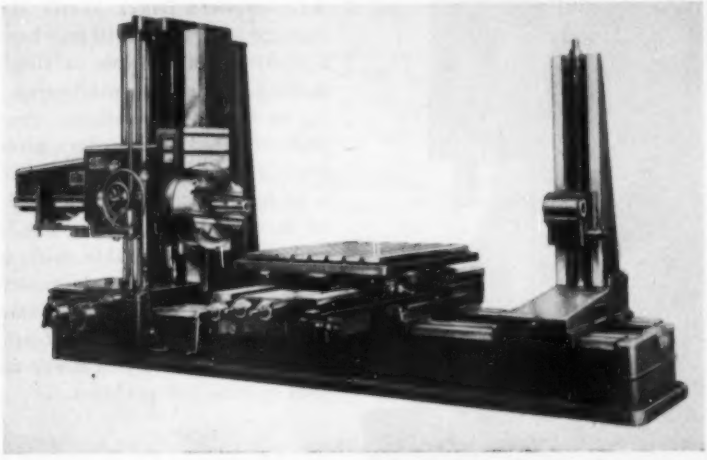

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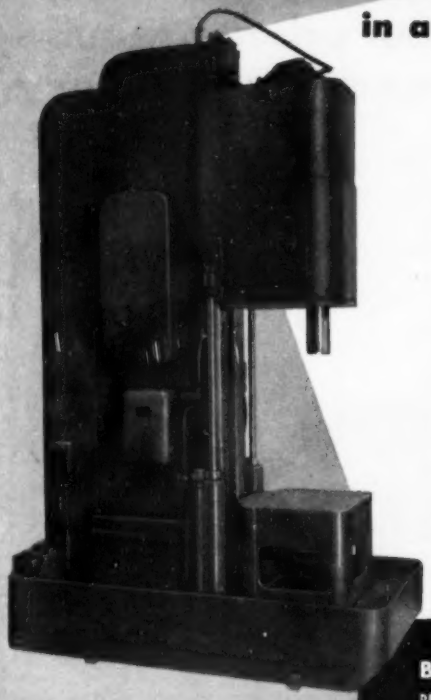

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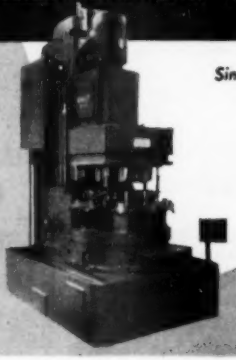

Illustrations show Baker 36HO as adapted for drilling wrench bodies for a leading manufacturer of crescent wrenches. Estimated production rate is 103 parts per hour at 100% efficiency. Machine is easily converted for operations on varying sizes of wrenches.

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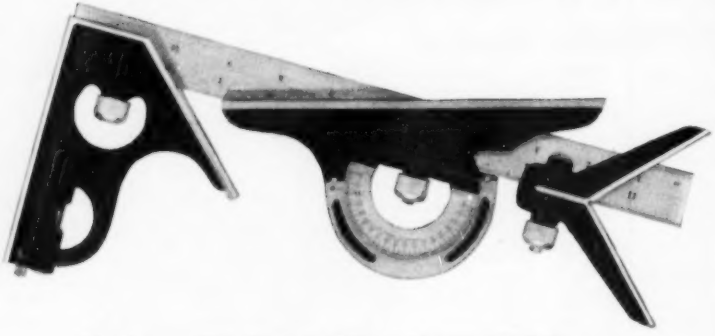

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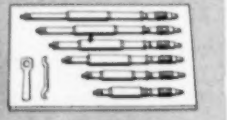

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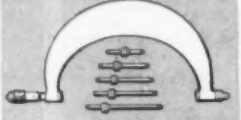

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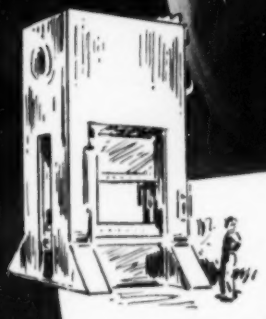

Press cylinder produced by Midvale for 11,000 ton capacity press for large steel plant in southwest.
DIMENSIONS:
Length outside: 7 ft., 10⅛ in.
Length inside: 6 ft., 11¼ in.
Outside Diameter: 66 in. (± 1/32 in.)
Inside Diameter: 51½ in. (± 1/32 in.)

A REGULAR JOB FOR MIDVALE CRAFTSMEN

When the job is big . . . the specifications exacting . . . and the quality to be unsurpassed . . . let Midvale do it.

Press cylinders are one example of Midvale's "extra" in service and quality. For years we have made press cylinders for our own huge presses . . . gained untold experience so we could make our customers' products better . . . built this "first-hand know-how" into the finest, most dependable cylinders industry can produce.

Midvale's modern plants are equipped to make, shape, heat-treat and machine parts for giants in all industries. Pressure vessels for the petroleum and chemical industries . . . rolls for the paper industry . . . roll shells and rings for the mining and cement industries . . . weldless rings for turbines and gears . . . castings and forgings for all industries. If the job is big and must be exact, let Midvale engineers and craftsmen help you.

THE MIDVALE COMPANY
NICETOWN, PHILADELPHIA, PENNA.
OFFICES: NEW YORK • CHICAGO • PITTSBURGH
WASHINGTON • CLEVELAND • SAN FRANCISCO

MIDVALE

Custom Steel Makers to Industry

PRODUCERS OF FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS

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QUALITY YOUNGSTOWN SERVICE

SCRAPPY SAYS:

AID DEFENSE

MORE SCRAP TODAY...

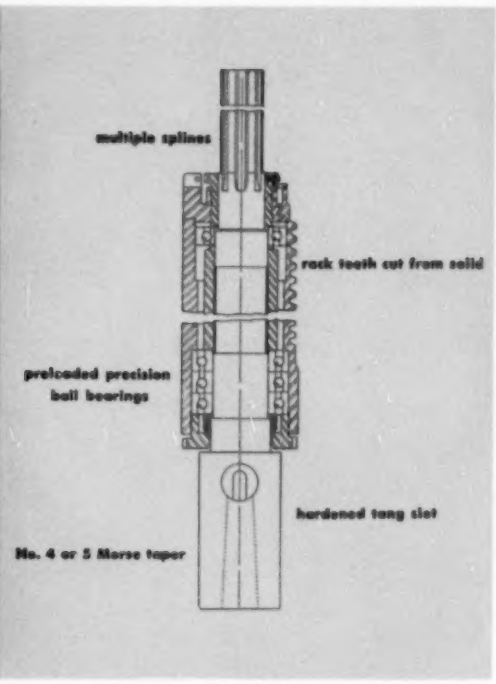
MORE STEEL TOMORROW

THE iron and steel industry faces a serious scrap shortage, growing more critical every day. . . . It will be impossible for producers to make the steel tonnages demanded for rearmament and essential civilian needs, unless consumers cooperate by furnishing *more scrap*. . . . Most desperately needed now is heavy industrial iron and steel scrap. . . . Keep the cobwebs from gathering at your own plant by turning in more of your own scrap today.

The Youngstown Sheet and Tube Company

General Offices—Youngstown 1, Ohio
Export Offices—500 Fifth Avenue, New York
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment



ACCURATE / FLEXIBLE

Cincinnati Gilbert spindles stay right on the "O" even under the strain of improperly sharpened drills, uneven depths of cut, as well as normal thrust loads of feeding. The heavy 4¼" OD alloy steel quill has a 12-inch long bearing in the head, and the spindle is mounted in the quill with three ABEC No. 5 precision preloaded angular contact ball bearings at the bottom and one at the top . . . Take full advantage of your radials and boring mills with the added flexibility of Cincinnati Gilbert Universal Tables. Just one setup enables you to drill, tap, etc., five sides of the work up to 90°. Four point support in the horizontal position assures maximum rigidity, no strain on the worm . . . In the photo above the operator drills and taps a total of 35 holes, on five faces of the casting. Write for Bulletin 850.

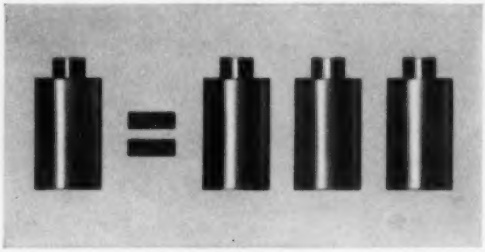
RADIALS
HORIZONTAL BORING MILLS
ACCESSORIES

THE CINCINNATI
GILBERT
MACHINE TOOL COMPANY
3366 BEEKMAN ST. • CINCINNATI 23, OHIO

THOSE WHO BUY GILBERT BUY GILBERT AGAIN

GRAPH-MO STEEL SETS NEW STANDARDS OF GAGE PERFORMANCE!

Most stable gage steel ever made—outwears others 3 to 1!



12-YEAR STABILITY TEST SHOWS ONLY 10 MILLIONTHS CHANGE IN GRAPH-MO STEEL GAGE

The introduction of Graph-Mo steel to the gage industry has opened the door to new standards of gage performance unattainable with conventional gage steels! New stability! New wearability! New machinability!

Proof of Graph-Mo's outstanding stability is the series of measurements shown below, taken on a typical Graph-Mo steel plug gage. After a period of twelve years this gage measured within ten millionths of an inch of its original dimension.

1940—1.73996	1944—1.73996
1941—1.73995	1945—1.73997
1942—1.73998	1948—1.73997
1943—1.73997	1951—1.73995

REPORTS FROM USERS SHOW GRAPH-MO STEEL OUTWEARS OTHER TOOL STEELS 3 TO 1

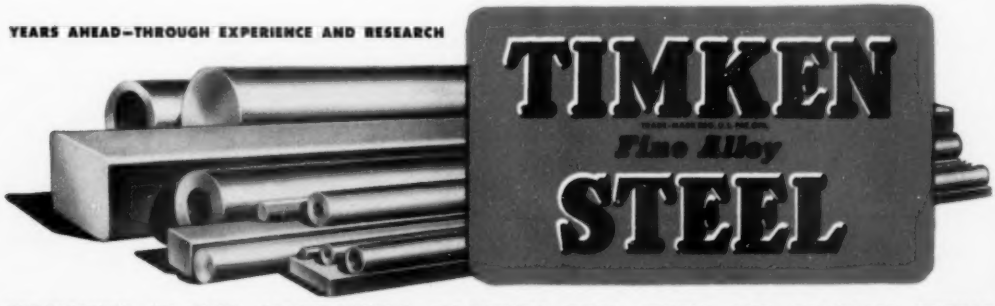
Graph-Mo—a Timken® graphitic tool steel—contains free graphite and diamond-hard carbides. As a result, it has minimum tendency to scuff, or gall, and stubbornly resists wear. Reports from users who have switched to Graph-Mo steel gages show that it outwears other tool steels an average of 3 to 1!

Graph-Mo machines 30% faster than other tool steels, takes a smoother finish, and *is available now!*

You can always tell Graph-Mo by its "graphitic look"—tiny, scattered, parallel marks barely visible on the surface of a piece of polished Graph-Mo. This built-in "trade mark", result of free graphite in its structure, can't be duplicated in other steels. Look for it, insist upon it, next time you buy gages.

Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH



SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING